Chapter 3.0
Affected Environment

3.1 INTRODUCTION

This Chapter provides a description of the human and natural environmental resources as they currently exist that could be affected by the Proposed Action and any of the other Alternatives. The environment described is the baseline for the comparisons in Chapter 4, Environmental Consequences. Table 3.1-1 provides a list of potentially impacted resources which are analyzed in this EIS.

Table 3.1-1
Potentially Impacted Resources

Resources	Not Present on Location	No Impact	Potentially Impacted
PHYSICAL RESOURCES			
Air Quality and Climate			X
Geological Resources			X
Mineral Resources			X
Soils			X
Floodplains	X	X	
Coastal Zone Areas	X	X	
Water (Surface, Groundwater, and Water Use)			X
Federal Water Reserve	X	X	
BIOLOGICAL RESOURCES			
Invasive, Non-native Species			X
Vegetation			X
Wetlands and Riparian			X
Special Status Species			X
Wildlife			X
Wild Horse and Burros			X
HERITAGE RESOURCES AND HUMAN ENVIRONMENT			
Cultural Resources: Property of historic, archeological, or architectural significance (including sites on or eligible for the National Register of Historic Places and the National Registry of Natural Landmarks			X
Paleontological Resources			X
Tribal and Native American Religious Concerns			X
Visual Resources		X	
Socioeconomic			X
Environmental Justice			X
Transportation/Access			X
Public Health and Safety			X
Wastes, Hazardous or Solid			X
LAND RESOURCES			
Prime or Unique Farmlands	X	X	
Recreation including travel management			X
Livestock Grazing			X
Realty Actions			X
Fire and Fuels		X	
Special Designations	X	X	

For those resources identified in Table 3.1-1 that are either not present or would not be impacted by the alternatives, clarifying information is provided below.

Visual Resources. The BLM visual resource inventory established Visual Resource Management (VRM) classes in the Project Area as VRM Class IV. All of the alternatives analyzed in the Final EIS for the Lander RMP manage the Project Area as VRM Class IV (BLM, 2013a). The VRM Class IV objective is: "Provide for management activities which require major modification to the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt will be made to minimize the activities through careful location, minimal disturbance, and repeating the basic elements" (BLM, 1986).

The natural features of the characteristic landscape have been significantly altered through prior mining using primarily surface mining methods which produced pits and waste rock piles. The Project Area contains mine roads, aboveground electrical utility lines and remnant mine facilities. A network of roads including extensive benches has been cut into surrounding hillsides. Most of these have not been reclaimed. There are no developed recreation areas to attract recreational viewers and none of the major historic trails are within the viewshed of the Project Area. Ranching and agriculture have introduced modifications such as fence lines, corrals, and stock tanks.

Viewer sensitivity to the visual environment in the Project Area is considered to be low. The Heap Leach Pad and On-Site Ore Processing Facility would be visible from the Crooks Gap/Wamsutter Road; however, because the processing facility and heap leach area is currently covered in white spoils material from the McIntosh Pit, there is no anticipated change to the view from Crooks Gap/Wamsutter Road. Additionally, the location of the Heap Leach Pad and On-Site Ore Processing Facility was chosen based on the advantage of overlapping existing disturbance, gentle topography, and land status (see Section 2.6.2.1), and there were no opportunities to hide or otherwise minimize the view of the processing facility from the Crooks Gap/Wamsutter Road. There are very few residences in the vicinity and no major travel corridors pass within viewing distance. The number of viewers in the vicinity is small and most viewers are there for work related to energy development or ranching; work related viewers are generally not considered to be highly sensitive to visual resource conditions. For these reasons, it was anticipated that no impacts to visual resources would occur.

Prime or Unique Farmlands. According to the Natural Resources Conservation Service (NRCS) soil survey (NRCS, 2014), there are three soil map units within the eastern part of Fremont County that are determined to be prime farmland, but only when irrigated (Biltoft, 2010). These three soil map units were not found within the Soil Analysis Area during the BKS (2014a), NRCS (2014), or 1980 historical soil surveys.

Fire and Fuels. The fire and fuels program treats an average of 10,000 acres per year, although this amount may be reduced because of budget limitations and the unlikelihood of prescribed fire treatment in greater sage-grouse Core Area. The fire and fuels program would be little impacted by any of the alternatives (Fremont County Volunteer Fire Association would respond to any fire occurring at the Project Area). Accordingly, the program will not be analyzed for impacts associated with the alternatives. Energy Fuels would employ their own fire suppression program for safety reasons throughout the Project Area. Fuels within the Project Area could consist of various vegetation including grasses, sagebrush, and various pine species. Impacts to these fuels as a result of the Project are described in the Vegetation and Special Status Species sections of this document.

Special Designations/Congressionally Designated Trails. Five Congressionally-designated trails are located in the Lander Field Office planning area; four National Historic Trails (NHTs) and one national scenic trail. These are in the general vicinity of the Project Area (the closest NHT is about 6 miles to the north and the national scenic trail is about 1.6 miles to the southwest). The Lander RMP (BLM, 2013a) established a National Trail Management Corridor (NTMC) with protections for the viewshed and setting of the NHTs. The boundaries of the NTMC were established based on a viewshed analysis of what can be seen from the NHTs. The proposed project is outside of the NTMC. The RMP also limits projects outside of the NTMC if they are "highly visible" and/or "out of scale" with the surrounding environment (Decision 7008). The BLM determined that no alternative in the EIS would meet the conditions of Decision 7008 so no further analysis of impacts to the NHTs under any alternative was deemed necessary. The BLM performed a viewshed analysis specific to this project. The majority of the project is not visible from the NHTs, and the small portion that is visible is within existing disturbance, resulting in no visual impacts to the NHTs.

Special Designations/Wild and Scenic Rivers. There are no wild and scenic rivers near the Project Area, that are either currently part of the Wild and Scenic River System or that are identified in the Lander RMP (BLM, 2013a). The closest river segments managed to maintain their wild and scenic character are reaches of the Sweetwater River over 10 miles to the north of the Project Area. Therefore, environmental impacts from any of the alternatives will not be analyzed.

Special Designations/Areas of Critical Environmental Concern (ACECs). ACECs are defined in 43 CFR § 1610.0-5 as areas 1) with relevant values (historic, cultural, scenic, wildlife or natural systems or safety issues); 2) with important values that are more than locally significant; and 3) which require special management to prevent irreparable damage. The Lander RMP (BLM, 2013a) designates ACECs including the expanded Green Mountain ACEC for elk habitat (see Map 3.3-4, below). The ACEC is not designated because of its visual resource values, although like all ACECs in the Lander management area, the Green Mountain ACEC is managed as visual resource Class II. The elk habitat that is protected by the ACEC would not be impacted by any of the alternatives. Any potential impacts to elk outside of the ACEC is analyzed in the wildlife section. Accordingly, there will be no additional analysis of ACECs in the impacts section.

Special Designations/Wilderness, Wilderness Study Areas, and Lands with Wilderness Characteristics. No BLM-managed wilderness areas occur in the vicinity of the Project Area. The nearest wilderness area is on the Shoshone National Forest approximately 45 miles to the west.

No BLM Wilderness Study Areas (WSAs) are in close proximity to the Project Area. The Sweetwater Canyon WSA is 28 miles to the west and the Sweetwater Rocks complex of four WSAs is more than 13 miles to the northeast. While the Sweetwater Rocks complex is visible from the Project Area, it is too distant to be influenced by activities in the Project Area.

The Lander Field Office completed a new inventory of non-WSA lands with wilderness characteristics, (often called Lands with Wilderness Characteristics). The only Lands with Wilderness Characteristics identified in the inventory (other than existing WSAs) were in the Dubois area, more than 100 miles northwest of the Project Area.

3.2 PHYSICAL RESOURCES

3.2.1 Climate and Air Quality

3.2.1.1 Climate

The Project Area is located in a semiarid (dry and cold), mid-continental climate regime. The area is typified by dry, windy conditions with limited rainfall and long, cold winters. Meteorological measurements are collected 1) at a 10-meter meteorological station operated by Energy Fuels and located on-site in the Project Area and 2) at the National Climate Data Center Coop Site No. 484925 at Jeffrey City, located 8 miles north of the Project Area at an elevation of 6,330 feet amsl (Western Regional Climate Center - WRCC, 2013). Both sites are shown on Map 3.2-1. Meteorological data has been collected at the Sheep Mountain site since 2010 and at the Jeffrey City site since 1964.

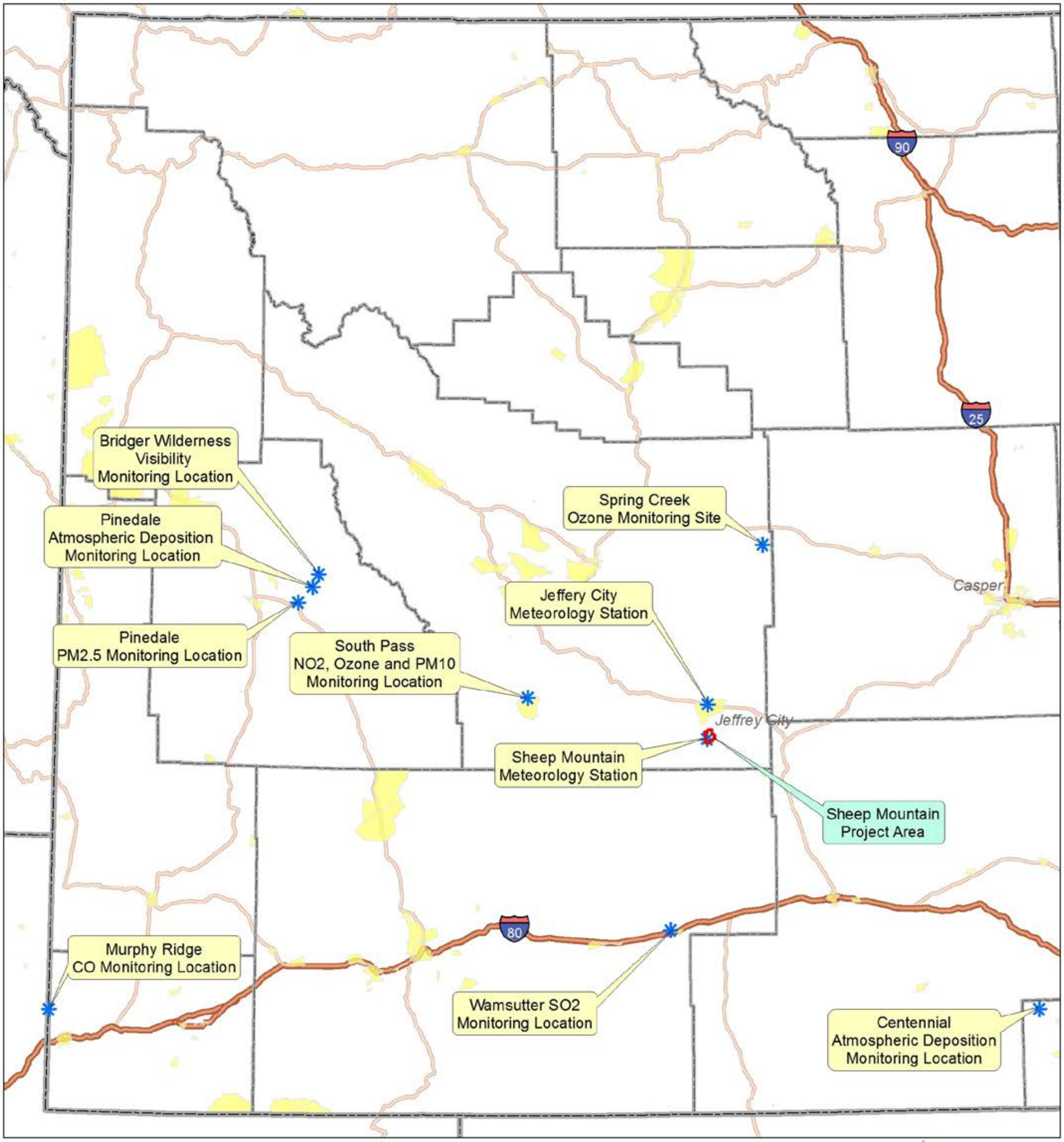
Local Climate

The annual average total precipitation at Jeffrey City is 9.80 inches, with annual totals ranging from 5.1 inches (2005) to 13.2 inches (1993). Precipitation is greatest in the spring, with consistent precipitation through summer and autumn and significantly lower precipitation totals during the winter months. An average of 56.9 inches of snow falls during the year (annual high 100.0 inches in 2009), with snowfall occurring predominantly from October through May.

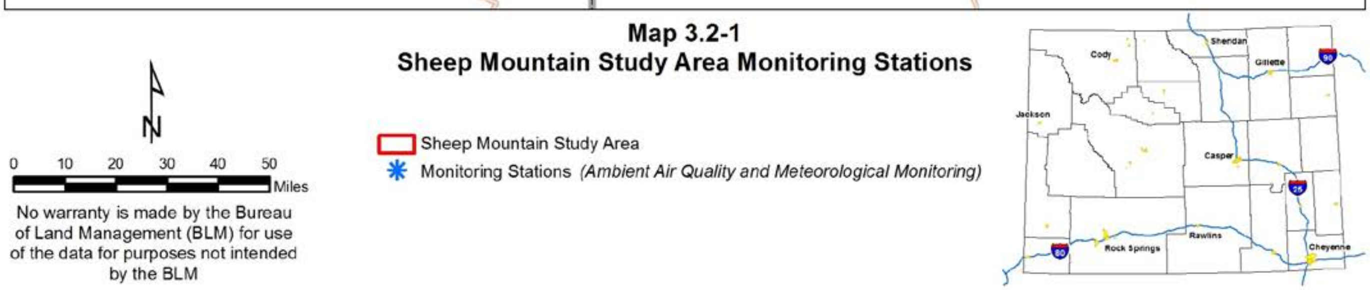
The region has cool temperatures, with average temperature (in degrees Fahrenheit - ˚F) ranging between 8.7˚F and 30.7˚F in January to between 49.8˚F and 85.1˚F in July. Extreme temperatures have ranged from -39˚F (1979) to 98˚F (2002). The frost free period generally occurs from June to August. Table 3.2-1 shows the mean monthly temperature ranges and total precipitation amounts. As this table makes clear, the Project Area exhibits broad swings in climate including both temperature and precipitation. Averages are not predictive of either temperature or precipitation which can vary dramatically from year to year and from the average.

Table 3.2-1
Mean Monthly Temperature Ranges and Total Precipitation Amounts
Jeffrey City, Wyoming

Month	Average Temperature Range (˚F)	Total Precipitation (inches)
January	8.7 – 30.7	0.36
February	10.1 – 33.6	0.44
March	18.8 – 43.8	0.79
April	26.4 – 54.5	1.20
May	34.6 – 64.1	1.95
June	42.6 – 75.3	1.03
July	49.8 – 85.1	0.83
August	48.2 – 82.8	0.60
September	38.2 – 72.2	0.74
October	28.7 – 58.8	0.86
November	17.2 – 41.2	0.54
December	9.3 – 30.6	0.46
ANNUAL	41.9 (mean)	9.80 (mean)
Source: WRCC, 2013.		



Map 3.2-1
Sheep Mountain Study Area Monitoring Stations



While the Jeffrey City meteorological observations provide a longer-term representation of climate conditions near the Project Area, meteorological data is also collected at the Sheep Mountain site. The Sheep Mountain meteorological station was installed in August 2010. Hourly meteorological data collected at the 10-meter station includes: wind speed, wind direction, wind direction standard deviation, air temperature, delta temperature, solar radiation, relative humidity, and precipitation.

Hourly average wind speed and wind direction measurements collected at the Sheep Mountain 10-meter meteorological tower from January 2011 through December 2012 are shown in the wind rose plot, Figure 3.2-1. Approximately 56 percent of winds occurred from a south-southeasterly direction.

Table 3.2-2 provides the wind direction distribution at the Sheep Mountain site in a tabular format.

Table 3.2-2
Wind Direction Frequency Distribution,
Sheep Mountain Site, 2011 – 2012

Wind Direction	Frequency (%)
N	5.8
NNE	2.8
NE	1.9
ENE	1.8
E	1.0
ESE	1.2
SE	16.7
SSE	26.9
S	12.4
SSW	7.0
SW	5.2
WSW	4.7
W	4.1
WNW	1.6
NW	2.0
NNW	4.9

The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. Table 3.2-3 shows the frequency distribution of wind speeds in the Project Area. The annual mean wind speed over the 2-year period of record is 15.2 miles per hour (mph), and that relatively high average wind speed indicates the presence of good dispersion and mixing of any potential pollutant emissions resulting from the Project Area.

Table 3.2-3
Wind Speed Distribution, Sheep Mountain Mine, 2011 – 2012

Wind Speed (mph)	Frequency (%)
0 – 4.0	4.6
4.0 – 7.5	10.7
7.5 – 12.1	22.3
12.1 – 19.0	33.2
19.0 – 24.7	16.2
Greater than 24.7	13.0

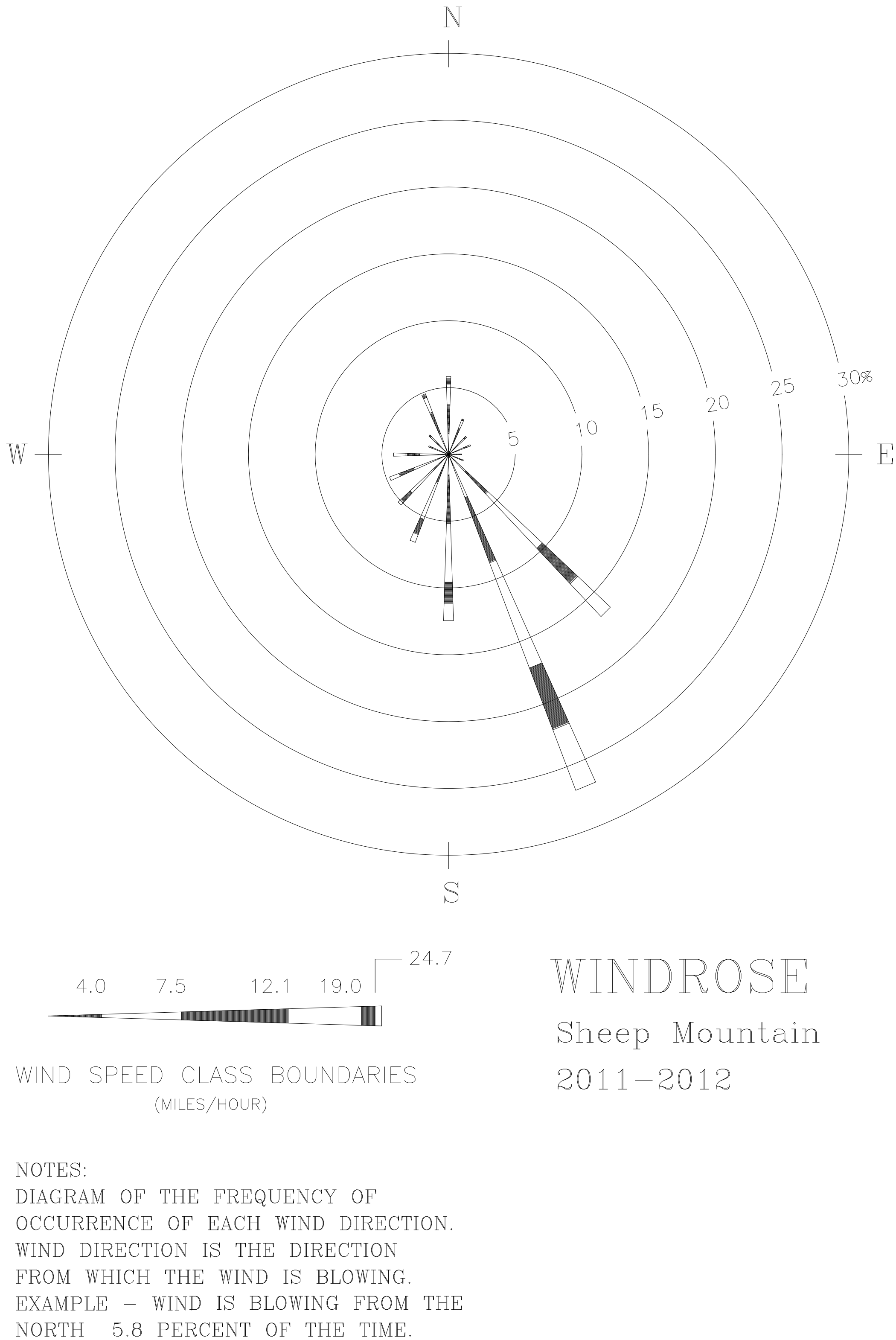


Figure 3.2-1
Sheep Mountain Meteorological Data Windrose

3.2.1.2 Air Quality

Air Pollutant Background

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based standards which define the maximum concentration of air pollutants allowed at all locations to which the public has access. The EPA has established NAAQS for carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM less than 10 microns in effective diameter - PM_{10} and particulate matter less than 2.5 microns in effective diameter - $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb).

All of the criteria pollutants listed above except lead are monitored at sites in the region. The monitored concentrations are used as an indicator of existing conditions in the region and establish existing compliance with ambient air quality standards. The concentrations are assumed to include emissions from industrial sources and from mobile, urban, biogenic, and other non-industrial emissions sources. The most representative monitored regional background concentrations available for criteria pollutants as identified by the WDEQ-AQD (WDEQ, 2014) are shown in Table 3.2-4. As shown in Figure 3.2-2, regional background concentrations are less than the NAAQS for all reported criteria pollutants. Monitoring for NO_2 and O_3 is also conducted at the Encana Spring Creek site, located 49 miles northeast of the Project Area. Monitoring values in 2013 for the Spring Creek site are provided in Table 3.2-5.

Table 3.2-4
Background Ambient Air Quality Concentrations

Pollutant	Averaging Period	Measured Background Concentration ($\mu g/m^3$)
CO[1]	1-hour 8-hour	904 572
NO_2[2]	1-hour Annual	9.4 1.9
O_3[2]	8-hour	131.5
PM_{10}[2]	24-hour Annual	49 11
$PM_{2.5}$[3]	24-hour Annual	27 7.0
SO_2[4]	1-hour 3-hour 24-hour Annual	18.3 18.3 3.9 0.6

[1] Data collected at Cheyenne, Wyoming during 2012, WDEQ-AQD
[2] Data collected at South Pass, Wyoming during 2012, WDEQ-AQD.
[3] Data collected in Rock Springs, Wyoming during 2012, WDEQ-AQD.

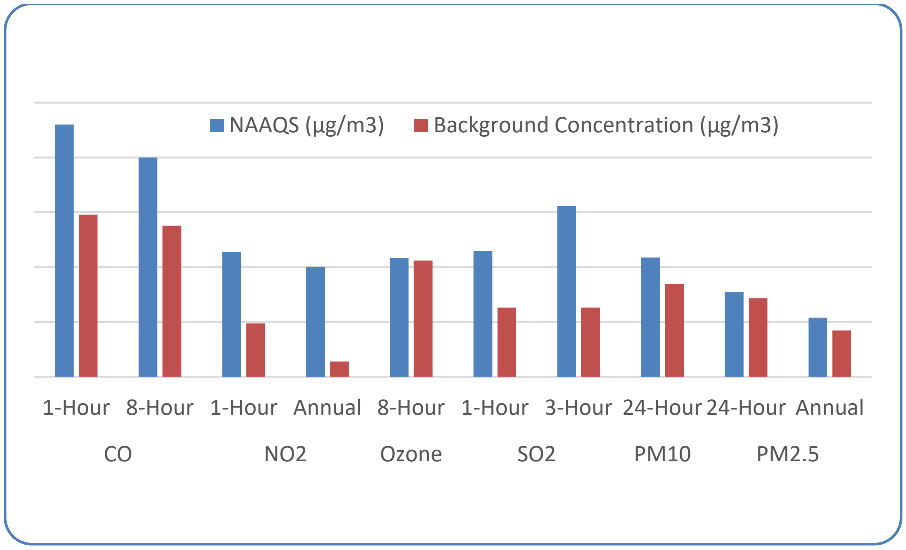


Figure 3.2-2
Regional Pollutant Concentrations Compared to NAAQS

Table 3.2-5
Spring Creek, Wyoming Monitored Air Quality Concentrations

Pollutant	Averaging Period	Measured Concentration
NO_2[1]	1-hour	7 ppm
O_3[2]	8-hour	0.066 ppm
[1] 98th percentile. Source: EPA AirData. [2] 4th high. Source: EPA AirData.		

3.2.1.3 Radiological Background

A pre-operational radiological baseline monitoring program was conducted by Energy Fuels at the Sheep Mountain site (Titan Uranium, 2011). The baseline conditions measured in this program are representative of the current radiological environment at the site. All monitoring was conducted in accordance with NRC guidance, which requires 12 consecutive months of ambient environmental radon and gamma radiation monitoring and 12 consecutive months of air particulate radionuclide monitoring (NRC, 1980).

Nine on-site air particulate monitoring stations were installed, with five stations installed in August 2010 and four in June 2011. All stations are currently on standby. Monitoring sites were selected in accordance with NRC guidance for radionuclide assessment of particulate sampling data. Passive gamma dose rate and radon measuring devices were co-located with the nine air particulate monitoring stations.

Monitoring results and reporting limits for ambient gamma dose rate monitoring are presented in Table 1 in Appendix 3-A. Results and reporting limits for passive radon monitoring are presented in Table 2 in Appendix 3-A. Tables 3 through 6 in Appendix 3-A presents monitored radionuclide concentrations based on ambient particulate monitoring data, as well as reporting limits for radionuclides.

Monitored results are generally within one order of magnitude of the reporting limits, and frequently less than five times the reporting limits, indicating relatively low radio particulate concentrations in air across the site. No clear trends of increase or decrease are evident despite the location of unreclaimed mine disturbance areas and old ore stockpiles in the monitored area with significant soil activity present (Titan Uranium, 2011).

3.2.1.4 Overview of Regulatory Environment

The WDEQ-AQD, under its EPA-approved State Implementation Plan, is the primary air quality regulatory agency responsible for determining potential impacts once detailed industrial development plans have been made, and those development plans are subject to applicable air quality laws, regulations, standards, control measures, and management practices. Therefore, the WDEQ-AQD has the ultimate responsibility for reviewing and permitting the Project prior to operation. Unlike the conceptual 'reasonable, but conservative' engineering designs used in NEPA analyses, the WDEQ-AQD air quality pre-construction permitting demonstrations were based on site-specific, detailed engineering values, which were assessed in the permit application review. Any facility which meets the requirements set forth under Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 6 would be subject to the WDEQ-AQD permitting and compliance processes. Energy Fuels has received an air quality permit under WAQSR Chapter 6, Section 2(m) to construct the Sheep Mountain Uranium Mine (Permit Number P0015550, dated July 6, 2015).

Federal air quality regulations adopted and enforced by the WDEQ-AQD limit incremental emission increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in federal Class I areas are strictly limited, while increases allowed in Class II areas are less strict. Through the PSD program, Class I areas are protected by Federal Land Managers (FLMs) by management of Air Quality Related Values (AQRVs) such as visibility, aquatic ecosystems, flora, fauna, etc.

The 1977 Clean Air Act amendments established visibility as an AQRV that FLMs must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. The Regional Haze Rule finalized in 1999 requires the states, in coordination with federal agencies and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

Ambient Air Quality Standards

The Clean Air Act requires the EPA to set NAAQS for pollutants considered to endanger public health and the environment. The EPA has developed NAAQS for criteria pollutants: CO, NO_2, particulate matter (PM_{10} and $PM_{2.5)}$, SO_2, O_3, and Pb. Lead emissions from Project sources are negligible and therefore, the lead NAAQS is not addressed in this analysis. States typically adopt the NAAQS but may also develop state-specific ambient air quality standards for certain pollutants. The NAAQS and the WAAQS are summarized in Table 3.2-6. PSD Class I and Class II increments are also included in Table 3.2-6.

Table 3.2-6
Ambient Air Quality Standards and PSD Increments

Pollutant/Averaging Time	NAAQS	WAAQS	Units[13]	PSD Class I Increment[1] (µg/m³)	PSD Class II Increment[1] (µg/m³)
CO					
1-hour[2]	35	35	ppm	--[3]	--[3]
8-hour[2]	9	9	ppm	--[3]	--[3]
NO_2					
1-hour[4]	100	100	ppb	--[3]	--[3]
Annual[5]	53	53	ppb	2.5	25
Ozone					
8-hour[6]	0.070[7]	0.075[10]	ppm	--[3]	--[3]
PM_{10}					
24-hour[2]	150	150	(µg/m³)	8	30
Annual[5]	--[8]	50	(µg/m³)	4	17
$PM_{2.5}$					
24-hour[9]	35	35	(µg/m³)	2	9
Annual[5]	12	12	(µg/m³)	1	4
SO_2					
1-hour[11]	75	75	ppb	--[3]	--[3]
3-hour[2]	0.5	0.5	ppb	25	512
24-hour[2]	--[12]	--[8]	ppb	5	91
Annual[5]	--[12]	--[8]	ppb	2	20

1 The PSD demonstrations serve information purposes only and do not constitute a regulatory PSD increment consumption analysis.
2 No more than one exceedance per year.
3 No PSD increments have been established for this pollutant–averaging time.
4 An area is in compliance with the standard if the 98th percentile of daily maximum 1-hour NO_2 concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
5 Annual arithmetic mean.
6 An area is in compliance with the standard if the fourth highest daily maximum 8-hour ozone concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
7 On October 1, 2015, the EPA revised the NAAQS for 8-hour ozone concentrations from 75 ppb to 70 ppb. The effective date of the revised NAAQS is December 28, 2015 (EPA, 2015).
8 No standards are established for this pollutant-averaging time.
9 An area is in compliance with the standard if the maximum 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
10 The EPA revised the NAAQS for this pollutant (effective December 28, 2013) and the WDEQ has not yet adopted the revised NAAQS as part of their rulemaking.
11 An area is in compliance with the standard if the 99th percentile of daily maximum 1-hour SO_2 concentrations in a year, averaged over 3 years, is less than or equal to the level of the standard.
12 The NAAQS for this averaging time for this pollutant has been revoked by EPA.
13 ppm=parts per million, ppb=parts per billion, µg/m³=micrograms per cubic meter.

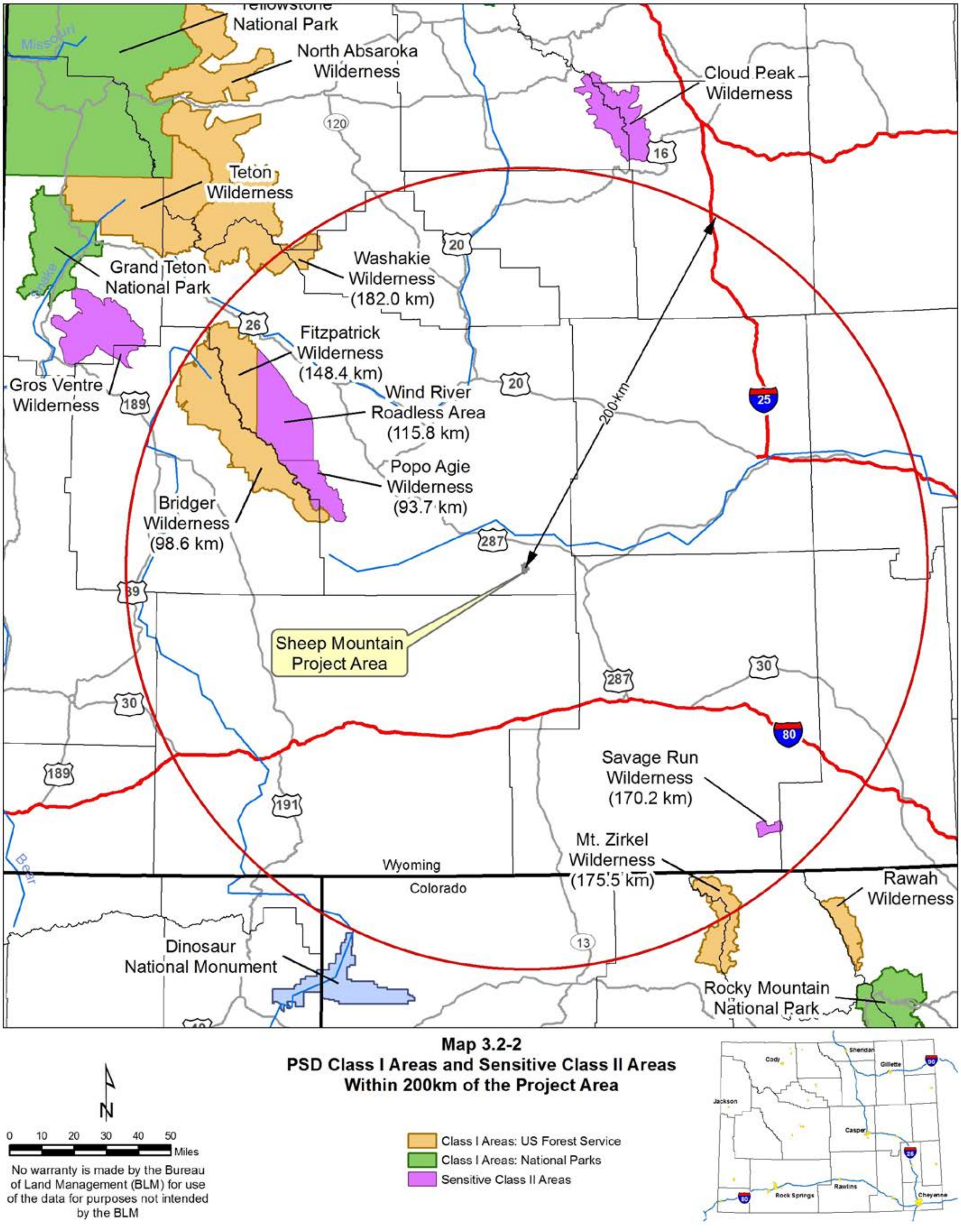
An area that is shown to exceed the NAAQS for a given pollutant may be designated as a nonattainment area for that pollutant. The Project Area is located in an area that is currently designated as attainment for all pollutants. On October 1, 2015, the EPA lowered the ozone NAAQS from 75 ppb (established in 2008) to a more stringent value of 70 ppb (EPA, 2015). The EPA expects to issue detailed guidance on the designation process in early 2016, but has indicated that attainment designations for the 2015 NAAQS will be based on 2014-2016 data. State recommendations for designations of attainment and nonattainment areas are due to EPA by October 1, 2016 and EPA will finalize designations by October 1, 2017. Therefore, at the time of writing of this document, the attainment status of the Project Area and all Wyoming counties under the 2015 ozone NAAQS is not yet known and the designations under the 2008 NAAQS remain in place.

Prevention of Significant Deterioration

The PSD Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. All areas of the country are assigned a classification which describes the degree of degradation to the existing air quality that is allowed to occur within the area under the PSD permitting rules. Federal Class I areas are areas of special national or regional natural, scenic, recreational, or historic value, and very little degradation in air quality is allowed by strictly limiting industrial growth. Class II areas allow for reasonable industrial/economic expansion. National parks and certain wilderness areas are designated as Class I. Air quality in these areas is protected by allowing only slight incremental increases in pollutant concentrations. These incremental increases, or PSD Class I Increments, are shown in Table 3.2-6. All other areas not designated Class I are classified as Class II, where less stringent limits on increases in pollutant concentrations apply. The Project Area and surrounding areas are classified as PSD Class II.

Comparisons of project impacts to the PSD Class I and II increments are for informational purposes only and are intended to evaluate a threshold of concern. They do not represent a regulatory PSD Increment Consumption Analysis, which would be completed as necessary during the New Source Review permitting process by the WDEQ-AQD.

In addition to the PSD increments, Class I areas are protected by the FLMs through management of AQRVs such as visibility, atmospheric deposition, aquatic ecosystems, flora, fauna, etc. Evaluations of potential impacts to AQRVs are also performed during the New Source Review permitting process under the direction of the WDEQ-AQD in consultation with the FLMs. Certain Class II wilderness areas in the region have been identified by federal managers as “sensitive areas” and AQRVs have been identified as a concern. The closest federal PSD Class I area is the Bridger Wilderness Area, which is approximately 99 kilometers – km (61 miles) west-northwest of the Project Area. All federal PSD Class I areas and the sensitive Class II areas within 200 km (124 miles) of the Project Area are shown on Map 3.2-2. Impacts are also evaluated for the Wind River Roadless Area, Popo Agie Wilderness Area, Savage Run Wilderness Area (Map 3.2-2), and federal Class II areas designated as sensitive. The Savage Run Wilderness Area is afforded Class I protection by the WDEQ-AQD under WAQSR Chapter 9, Section 2(c)(iii) and is subject to PSD Class I Increments shown in Table 3.2-6. Other sensitive Class II areas are subject to PSD Class II Increments and are also shown in Table 3.2-6.



Map 3.2-2
PSD Class I Areas and Sensitive Class II Areas Within 200km of the Project Area

Air Quality Related Values

An evaluation of potential impacts to AQRVs such as visibility, aquatic ecosystems, flora, fauna, etc. would be performed as part of a PSD Air Quality Analysis for a major source under the direction of the WDEQ-AQD in consultation with FLMs.

Visibility

The 1977 Clean Air Act amendments established visibility as an AQRV that FLMs must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I areas. The Regional Haze Rule finalized in 1999 requires the states, in coordination with federal agencies and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

Change in atmospheric light extinction relative to background conditions is used to measure regional haze. Analysis thresholds for atmospheric light extinction are set forth in Federal Land Managers' Air Quality Related Values Workgroup - FLAG (2010), with the results reported in percent change in light extinction and change in deciviews (dv). A 5 percent change in light extinction (approximately equal to a 0.5 change in dv) is the threshold recommended in FLAG (2010) and is considered to contribute to regional haze visibility impairment. A 10 percent change in light extinction (approximately equal to 1.0 dv) is considered to represent a noticeable change in visibility when compared to background conditions.

Visibility conditions can be measured as standard visual range (SVR). SVR is the farthest distance at which an observer can just see a black object viewed against the horizon sky; the larger the SVR, the cleaner the air. Visibility for the region is considered to be very good. Continuous visibility-related optical background data have been collected in the PSD Class I Bridger Wilderness, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. The average SVR at the Bridger Wilderness is over 200 km or 124 miles (Visibility Information Exchange Web System – VIEWS, 2012).

Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and it is reported as the mass of material deposited on an area per year in kilograms per hectare per year (kg/ha-yr). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of pollutants). The chemical components of wet deposition include sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4); the chemical components of dry deposition include SO_4, SO_2, NO_3, NH_4, and nitric acid (HNO_3).

The National Acid Deposition Program (NADP) and the National Trends Network (NTN) station monitors wet atmospheric deposition and the Clean Air Status and Trends Network (CASTNET) stations monitor dry atmospheric deposition at sites near Centennial/Brooklyn Lake, which is approximately 163 km (101 miles) south-southeast of the Project Area and Pinedale which is 170 km (105 miles) northwest of the Project Area, shown on Map 3.2-1. The total annual background deposition (wet and dry) reported as total nitrogen (N) and total sulfur (S) deposition for year 2012 at the Centennial site is 3.26 kg/ha-yr and 1.45 kg/ha-yr, respectively and is 1.31 kg/ha-yr nitrogren and 0.54 kg/ha-yr sulfur at the Pinedale site (EPA, 2013a).

FLAG (2010) recommends that applicable sources assess the impacts of nitrogen and sulfur deposition at Class I areas. This guidance recommends establishing critical deposition loading values ("critical loads") for each specific Class I area. Critical loads are the level of atmospheric pollutant deposition below which negative ecosystem effects are not likely to occur, and are completely dependent on local atmospheric, aquatic and terrestrial conditions, and chemistry.

FLAG (2010) guidance recommends the use of deposition analysis thresholds (DATs) developed by the NPS and the FWS, which are screening level values for N and S deposition from project-only emission sources below which estimated impacts are considered negligible. The DAT established for both nitrogen and sulfur in western Class I areas is 0.005 kg/ha-yr.

In addition to the project-specific analysis, results from cumulative emission sources are compared to critical load thresholds established for the Rocky Mountain region to assess total deposition impacts. The NPS has provided recent information on nitrogen critical load values applicable for Wyoming and Colorado Class I and sensitive Class II areas (NPS, 2014). For Class I and sensitive Class II areas in Wyoming, a critical load value of 2.2 kg/ha-yr for nitrogen deposition (estimated from a wet deposition critical load value of 1.4 kg N/ha-yr) is applicable, based on research conducted by Saros et al. (2010) in the eastern Sierra Nevada and Greater Yellowstone ecosystems. This is a critical load value that is protective of high elevation surface waters. For Colorado Class I and sensitive Class II areas, a critical load value of 2.3 kg N/ha-yr is applicable, based on research conducted by Baron (2006) that estimated 1.5 kg/ha-yr as a critical loading value for wet nitrogen deposition for high-elevation lakes in Rocky Mountain National Park, Colorado.

For sulfur deposition, the critical load threshold published by Fox et al. (1989) for total sulfur of 5 kg/ha-yr, for the Bob Marshall Wilderness Area in Montana and Bridger Wilderness Area in Wyoming, is used as critical load threshold for each of the Class I and sensitive Class II areas.

3.2.1.5 Greenhouse Gases and Climate Change

Greenhouse Gases

Greenhouse gases (GHGs) in the earth's atmosphere absorb outgoing thermal radiation and re-radiate some of that heat back towards the earth causing temperatures in the lower atmosphere and on the surface of the earth to be higher than they would be without atmospheric GHGs. Higher concentrations of GHGs amplify the heat-trapping effect resulting in higher surface temperatures. Some GHGs, such as water vapor, occur naturally in the atmosphere. Others, such as carbon dioxide (CO_2) and methane (CH_4), occur naturally in the atmosphere and are also emitted into the atmosphere by human activities. The anthropogenic GHGs of primary concern are: CO_2, CH_4, nitrous oxide (N_2O), and fluorinated gases. GHGs projected to be emitted by Sheep Mountain Project sources are CO_2, CH_4, and N_2O. The atmospheric lifetimes for these gases are on the order of decades. Emitted GHGs become well-mixed throughout the atmosphere and contribute to the global atmospheric burden of GHGs. Therefore, it is not possible to attribute a particular climate impact in any given region to GHG emissions from a particular source.

In 2007, the U.S. Supreme Court ruled in Massachusetts v. EPA that the EPA has the authority to regulate GHGs such as methane and carbon dioxide as air pollutants under the Clean Air Act. The ruling did not require the EPA to create any emission control standards or ambient air quality standards for GHGs. At present, there are no ambient air quality standards for GHGs, and there are no emissions limits on GHGs that would apply to the sources developed under the Project alternatives. There are applicable reporting requirements under the EPA's Greenhouse Gas Reporting Program. These GHG emission reporting requirements, finalized in 2010 under 40 CFR § 98, require industrial sources that emit 25,000 metric tons or more of carbon dioxide equivalent (CO_2e) per year to report GHG emissions annually.

Climate Change

Climate change is a statistically-significant and long-term change in climate patterns. The terms climate change and "global warming" are often used interchangeably, although they are not the same thing. Climate change is any deviation from the average climate, whether warming or cooling, and can result from both natural and human (anthropogenic) sources. Natural contributors to climate change include fluctuations in solar radiation, volcanic eruptions, and plate tectonics. Global warming refers to the apparent warming of climate observed since the early 20th century and is primarily attributed to human activities such as fossil fuel combustion, industrial processes, and land use changes.

The natural greenhouse effect is critical to the discussion of climate change. The greenhouse effect refers to the process by which GHGs in the atmosphere absorb heat energy radiated by Earth's surface and re-radiate some of that heat back toward Earth, causing temperatures in the lower atmosphere and on the surface of Earth to be higher than they would be without atmospheric GHGs. These GHGs trap heat that would otherwise be radiated into space, causing Earth's atmosphere to warm and making temperatures suitable for life on Earth. Without the natural greenhouse effect, the average surface temperature of Earth would be about 0˚F. Higher concentrations of GHGs amplify the heat-trapping effect resulting in higher surface temperatures. Water vapor is the most abundant GHG, followed by CO_2, CH_4, N_2O, and several trace gases. Water vapor, which occurs naturally in the atmosphere, is often excluded from the discussion of GHGs and climate change because its atmospheric concentration is largely dependent upon temperature rather than being emitted by specific sources. Other GHGs, such as CO_2 and CH_4, occur naturally in the atmosphere and are also emitted into the atmosphere by human activities.

Atmospheric concentrations of naturally-emitted GHGs have varied for millennia and Earth's climate has fluctuated accordingly. However, since the beginning of the industrial revolution around 1750, human activities have significantly increased GHG concentrations and introduced man-made compounds that act as GHGs in the atmosphere. The atmospheric concentrations of CO_2, CH_4, and N_2O have increased to levels unprecedented in at least the last 800,000 years. From pre-industrial times until today, the global average concentrations of CO_2, CH_4, and N_2O in the atmosphere have increased by around 40 percent, 150 percent, and 20 percent, respectively (IPCC - Intergovernmental Panel on Climate Change, 2013).

Human activities emit billions of tons of CO_2 every year. Carbon dioxide is primarily emitted from fossil fuel combustion, but has a variety of other industrial sources. Methane is emitted from oil and natural gas systems, landfills, mining, agricultural activities, and waste and other industrial processes and the gradual thawing of permafrost naturally emits frozen methane. Nitrous oxide is emitted from anthropogenic activities in the agricultural, energy-related, waste, and industrial sectors. The manufacture of refrigerants and semiconductors, electrical transmission, and metal production emit a variety of trace GHGs including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These trace gases have no natural sources and come entirely from human activities.

The current understanding of the climate system comes from the cumulative results of observations, experimental research, theoretical studies, and model simulations. The IPCC Fifth Assessment Report (AR5) (IPCC, 2013) uses terms to indicate the assessed likelihood of an outcome ranging from exceptionally unlikely (0–1 percent probability) to virtually certain (99–100 percent probability) and level of confidence ranging from very low to very high. The findings presented in AR5 indicate that warming of the climate system is unequivocal and many of the observed changes are unprecedented over decades to millennia. It is certain that Global Mean Surface Temperature has increased since the late 19th century and virtually certain (99–100 percent probability) that maximum and minimum temperatures over land have increased on a global scale since 1950. The globally averaged combined land and ocean surface temperature data show a warming of 1.5°F. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea-level rise, and in changes in some climate extremes. It is extremely likely

(95 to 100 percent probability) that human influence has been the dominant cause of the observed warming since the mid-20th century (IPCC, 2013). Findings from AR5 and reported by other organizations (National Aeronautics and Space Administration - NASA Goddard Institute for Space Studies, 2013; National Oceanic and Atmospheric Administration - NOAA National Climate Data Center, 2013) also indicate that changes in the climate system are not uniform and regional differences are apparent (BLM, 2014c).

National Assessment of Climate Change

The U.S. Global Change Research Program released the third U.S. National Climate Assessment (NCA) in May 2014. The Assessment summarizes the current state of knowledge on climate change and its impacts throughout the United States. It was written by climate scientists and draws from a large body of peer-reviewed scientific research, technical reports, and other publicly available sources. The Assessment documents climate change impacts that are currently occurring and those that are anticipated to occur throughout this century. It also provides region-specific impact assessments for key sectors such as energy, water, and human health.

The Assessment summarizes their conclusions in a number of Key Messages (NCA, 2014a), several of which are excerpted here:

- Global climate is changing and this change is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities.
- Global climate is projected to continue to change over this century and beyond. The magnitude of climate change beyond the next few decades depends primarily on the amount of heat-trapping gases emitted globally, and how sensitive the Earth’s climate is to those emissions.
- U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895; most of this increase has occurred since about 1970. The most recent decade was the nation’s warmest on record. Temperatures in the United States are expected to continue to rise. Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time.
- Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases. More winter and spring precipitation is projected for the northern United States, and less for the Southwest, over this century.
- Global sea level has risen by about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100.
- The oceans are currently absorbing about a quarter of the carbon dioxide emitted to the atmosphere annually and are becoming more acidic as a result, leading to concerns about intensifying impacts on marine ecosystems.

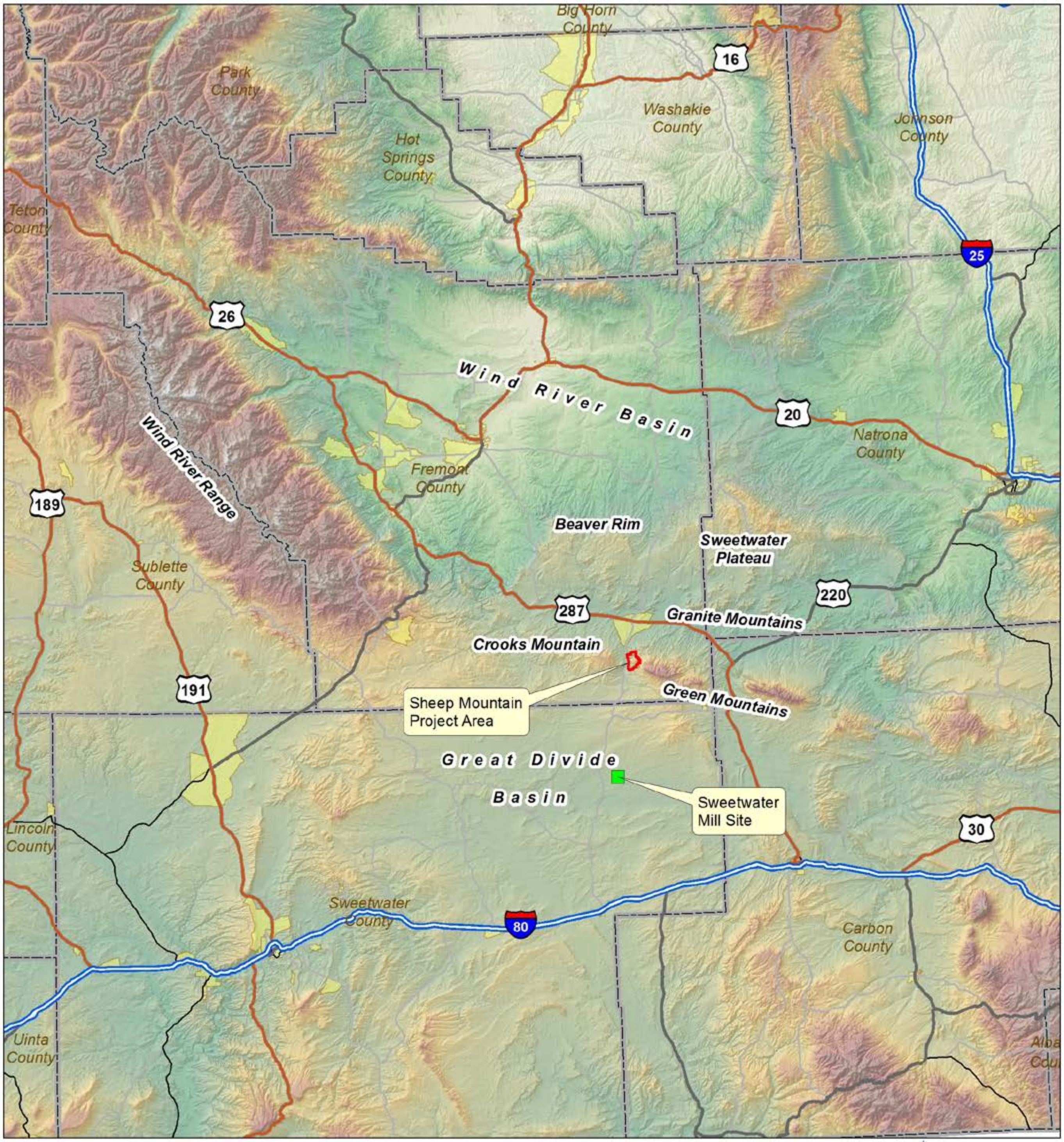
The Assessment provided analysis of projected climate change by region, and the Sheep Mountain Uranium Project is part of the Great Plains Region. The Key Messages for this region (NCA, 2014b) are as follows:

- Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs.
- Changes to crop growth cycles due to warming winters and alterations in the timing and magnitude of rainfall events have already been observed; as these trends continue, they will require new agriculture and livestock management practices.
- Landscape fragmentation is increasing, for example, in the context of energy development activities in the northern Great Plains. A highly fragmented landscape will hinder adaptation of species when climate change alters habitat composition and timing of plant development cycles.
- Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring within an already highly variable climate system.
- The magnitude of expected changes will exceed those experienced in the last century. Existing adaptation and planning efforts are inadequate to respond to these projected impacts.

3.2.2 Geologic Resources

3.2.2.1 Physiography and Topography

Physiography and topography throughout Wyoming is highly variable and represents a broad geologic setting. Wyoming's landscape is generally influenced by localized mountain systems that are part of the much larger Rocky Mountains (see Map 3.2-3). The mountains of Wyoming vary in style, size, and geology, but are often separated by basins. Basins in Wyoming are also variable in size and geology, but can be characterized by rolling plains, dissected drainages, and featureless terrain. The largest and most extensive mountain range in Wyoming is the Wind River Mountains in the south-central part of the state. The Wind River Basin occupies the area to the east of the Wind River Mountains, and the Great Divide Basin lies to the south (part of the Greater Green River Basin). The Sweetwater River runs from the southern portion of the Wind River Mountains to the south and east along the Sweetwater Plateau and through the Granite Mountains. The Granite Mountains and Sweetwater Plateau denote a broad elevated highland between the Great Divide Basin and the Wind River Basin. Steep escarpments along the Beaver Rim separate the Wind River Basin and the Sweetwater Plateau. Crooks Mountain, Green Mountain, and the Ferris Mountains create an east west trending mountain system that designates the boundary between the Great Divide Basin and the Granite Mountains; however, these mountains are not considered to occupy the Sweetwater Plateau (Love, 1970).



Map 3.2-3
General Features in the Project Area

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Legend

- Project Area Boundary
- Sweetwater Mill Site

The Project Area is located in the south-central part of Wyoming in an area known as Crooks Gap, and is part of the 40,000 square mile Wyoming Basin physiographic province which is typified by high elevation cold plains and mountains (Fenneman, 1928). The Project Area is located on Sheep Mountain which is part of the east-west trending mountain system that also includes Green Mountain to the east and Crooks Mountain to the west. Sheep Mountain is located at the southern margin of the Granite Mountains and the northern margin of the Great Divide Basin. The terrain in the area consists of rounded hills, incised drainages, ridges, bluffs, and some isolated mountainous areas. Elevations in the Project Area range from about 6,600 in the northwest corner to 7,835 feet at the top of Sheep Mountain. The topography within the Project Area is dominated by steep escarpments and mountainous terrain that has been influenced by historic mining activities.

Historically constructed drill pad access roads dissect the steep slopes throughout the Project Area (see Photo 3.2-1). The McIntosh Pit is representative of historic conventional mining efforts with vertical high walls on nearly every side and deep blue water created by groundwater rebound after mining of the pit ceased. Other mine workings on Sheep Mountain that have undergone some degree of reclamation include: the Seismic Open Pit, Reserve Shaft, Ravine and Congo inclines, Paydirt Open Pit, Sheep I and II shafts, Golden Goose I Shaft, and Heald Open Pit.

Photo 3.2-1
Historically Constructed Drill Pad Access Roads in the Project Area

3.2.2.2 Geology

Geology of the Sheep Mountain region is shown on Map 3.2-4 and Figures 3.2-3 and 3.2-4 and can be understood by describing the basins, stratigraphy, structural features, depositional history, and uranium deposition (Jones et al., 2011). The Granite Mountains were largely influential in the deposition of uranium-bearing strata within the Wind River and Great Divide basins and will be discussed throughout this analysis. Because the majority of Tertiary stratigraphy represents deposition from the Granite Mountains into both basins, the two basins contain similar sedimentology despite separate formational nomenclature.

Basins. The Project Area is situated on the structural boundary of the Great Divide Basin and Wind River Basin referred to as the Granite Mountains and Sweetwater Plateau. The Wind River Basin is an asymmetric synclinal structural and sedimentological basin that covers 8,500 square miles and contains nearly 20,000 feet of sediment (Keefer, 1965). The Great Divide Basin lies to the south of the Project Area and is an internally-drained closed basin composed of approximately 7,500 feet of Tertiary sedimentary rocks underlain by up to 13,000 feet of Mesozoic and Paleozoic sediments (Blackstone, 1991).

Stratigraphy. Rocks in the Sheep Mountain region range from Precambrian-age to Quaternary-age and are shown on Map 3.2-4.

Three ages and types define the Precambrian rocks in the Granite Mountains. The oldest rocks are chiefly composed of metasedimentary schist, slate, phyllite, quartzite, and diorite (Love, 1970). A similar metasedimentary rock cut by pegmatite dikes and containing spudomene is found on Black Mountain and the southern part of the Rattlesnake Hills. The majority of the Precambrian rocks that make up the Granite Mountains are composed of coarse-grained granite. The fractured granite is often cut by mafic dikes as evidenced in a discontinuous eastward trending belt along the north part of Sheep Mountain (Stephens, 1964).

Regional Quaternary-age rocks consist of alluvium within the Crooks Creek floodplain and alluvial fan deposits from Crooks Mountain and Sheep Mountain erosion. Quaternary sand dunes can be found in the basins to the north and south of the Project Area (Pipiringos, 1955). Thicknesses of individual formations vary considerably from place to place because of at least two angular unconformities within the Tertiary sequence (Stephens, 1964).

Tertiary stratigraphy includes the Miocence-age Moonstone and Split Rock formations, the Oligocene-age White River Formation, Eocene-age Ice Point Conglomerate, Wagon Bed, Wind River and Indian Meadows formations, lower Eocene-age Battle Spring Formation, and the Paleocene-age Fort Union Formation. The Tertiary rocks in the area are important in understanding the history of the Granite Mountains and the depositional history of both the Great Divide and Wind River basins.

The Moonstone Formation is the youngest of the Tertiary-age rocks within this report, and consists of uranium and thorium rich tuffaceous sandstone and lacustrine shales found only in the central Granite Mountains area (Love, 1970). The Split Rock Formation creates the gently south sloping Sweetwater Plateau and outcrops along the Beaver Rim. Four subdivisions complete the lithology of the Split Rock Formation: the lower porous sandstone sequence, the clayey sandstone sequence, the silty sandstone sequence, and the upper porous sandstone sequence. All of the subdivisions contain tuffaceous sediments. The upper porous sandstone sequence contains the Sweetwater moss agates popular with rock collecting enthusiasts.

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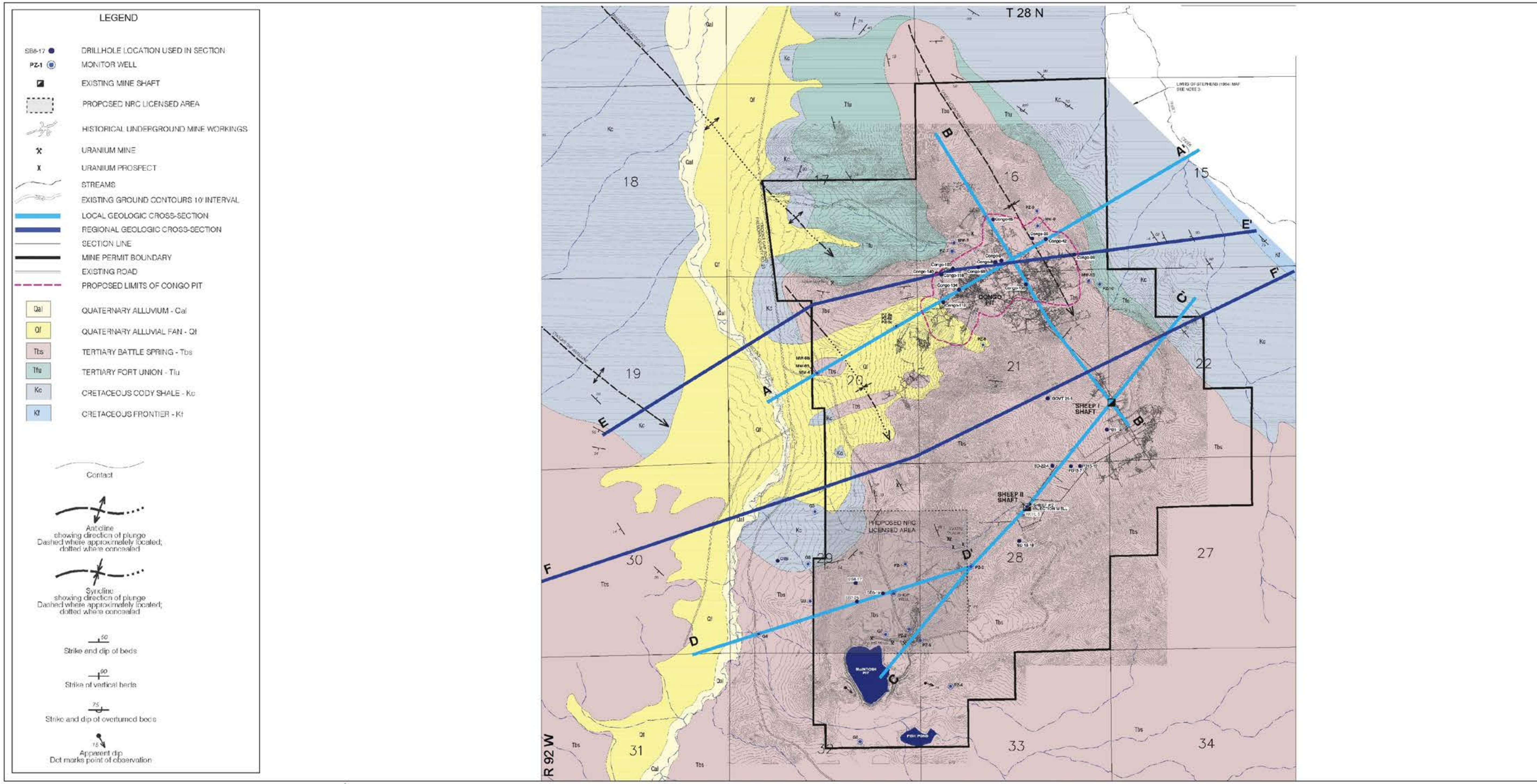

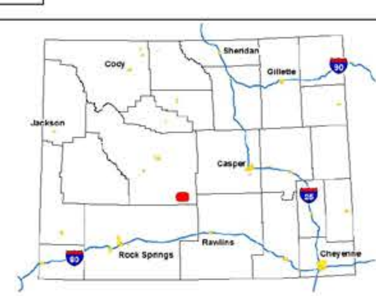

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Map 3.2-4
Regional Geology

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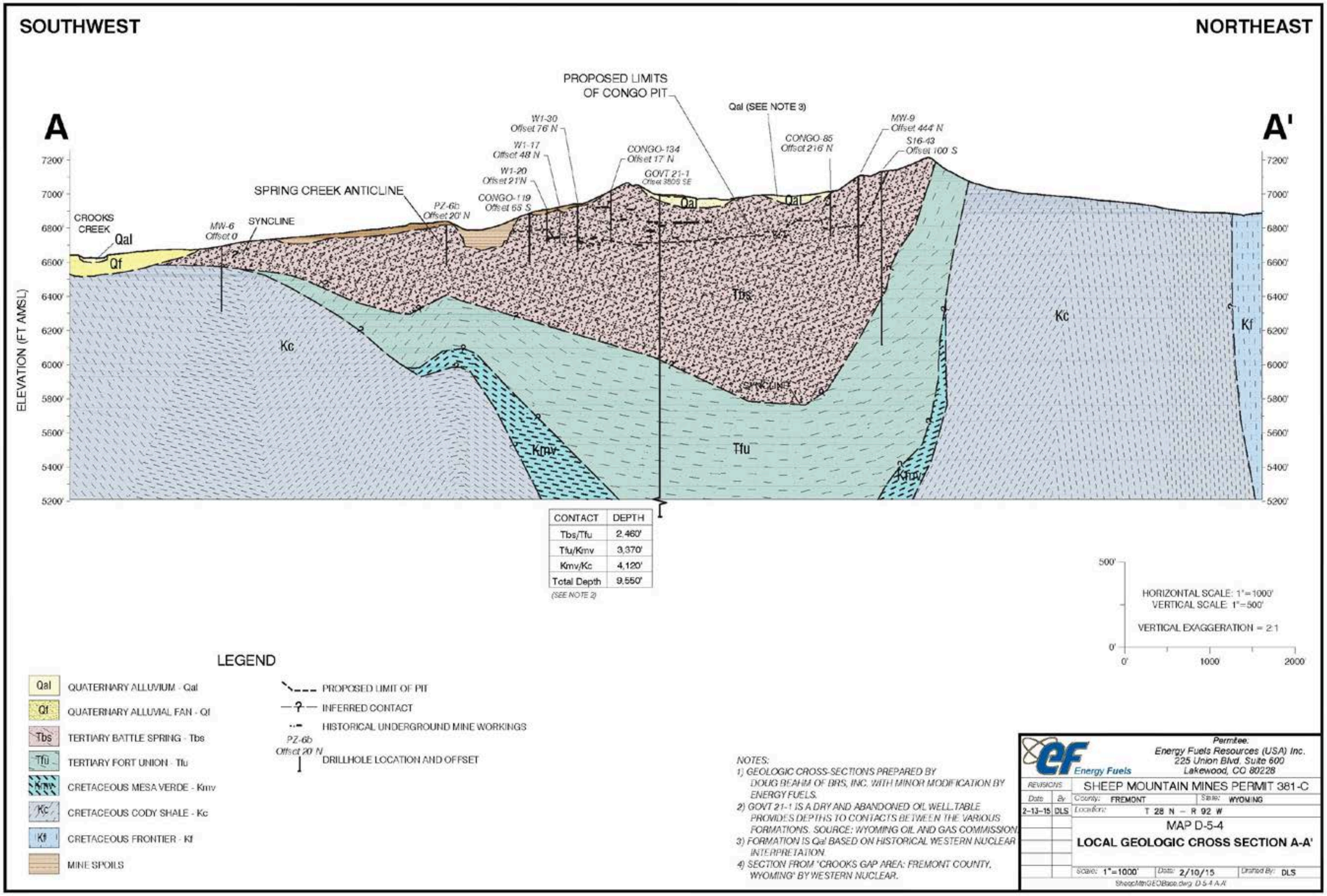


Figure 3.2-3
Local Geological Cross-Section A-A

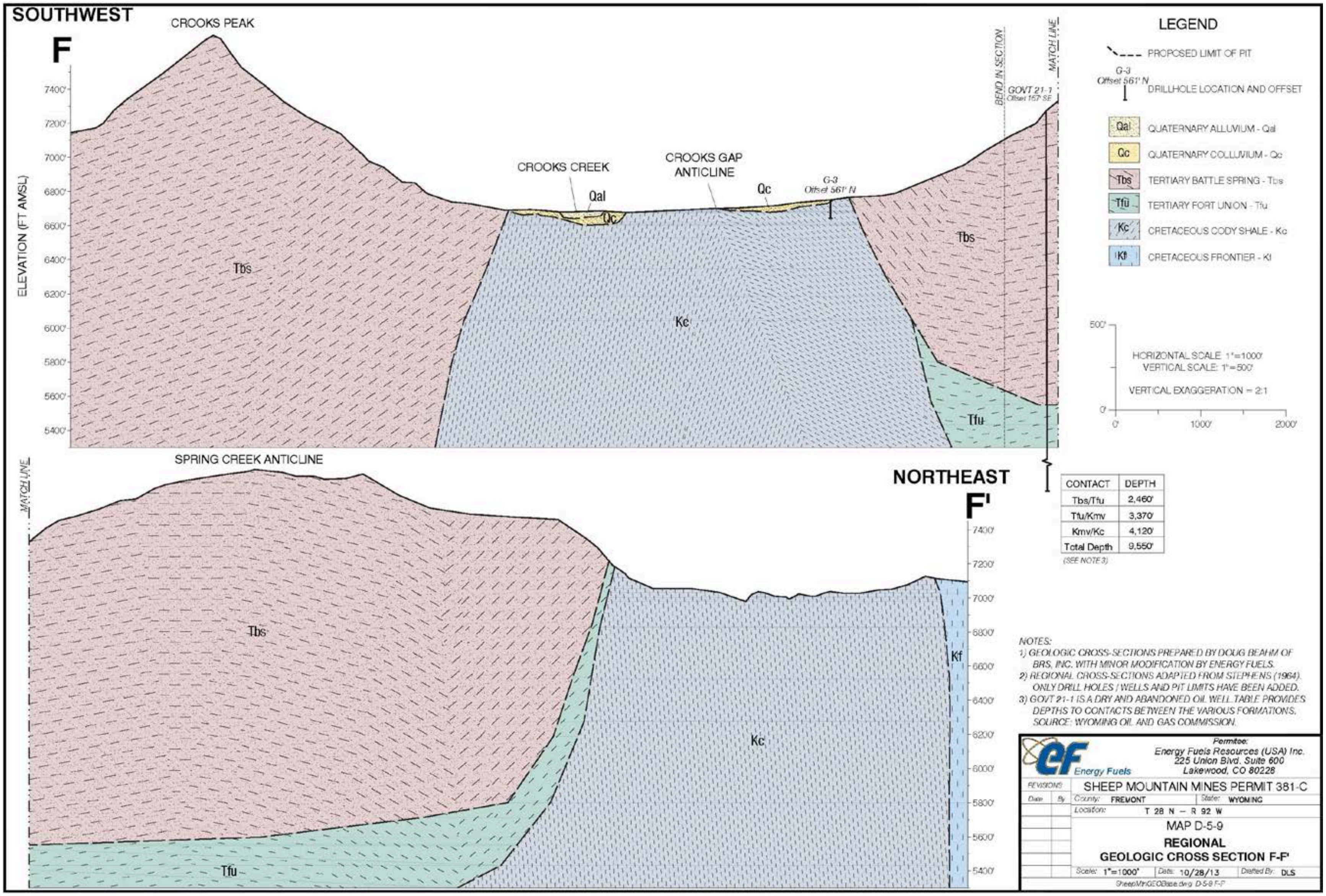


Figure 3.2-4
Local Geological Cross-Section F-F

Underlying the Split Rock Formation is the White River Formation of Oligocene age which is widely known as the cap of the Beaver Rim. The White River is composed of homogeneous massive white to grayish-orange sandy siltstone. Pumicite deposits (ash-fall) and large flakes of biotite, hornblende and magnetite distinguish the White River from the Split Rock. Volcanic rock fragments and tuff are found in cliffs of the White River Formation south of the Big Sand Draw oil and gas field (Love, 1970).

Several localized Eocene formations have been identified in the Sheep Mountain vicinity including the Ice Point Conglomerate and Wagon Bed Formation. The Ice Point Conglomerate is only found at the southern portion of the Granite Mountains and is principally composed of angular boulders and pebbles of Precambrian rocks, Flathead sandstone, Mesozoic sandstones, and Paleozoic limestones (Love, 1970). The Wagon Bed Formation is distinguished by large amounts of locally derived tuff sourced from the Rattlesnake hills and is generally considered part of the Wind River Formation (Van Houten, 1964).

Two additional formations that are not present near Sheep Mountain but are valuable in understanding the overall geologic setting are the Wind River and Indian Meadows formations. These formations are only visible north of the Beaver Rim within the Wind River Basin. The varying lithology of the Wind River Formation represents the depositional vicinity to numerous source rocks and varies between boulder conglomerates and fine-grained sandstones (Love, 1970). Precambrian and Paleozoic boulders are found within the Wind River Formation near the Granite Mountains while fine-grained sandstones are found near Lysite at the northern margin of the Wind River Basin. The Indian Meadows Formation consists of up to 6,000 feet of conglomeratic sandstone and lenses of carbonaceous siltstone, claystone, and shale found in outcrops in the northern part of the basin (Van Houten, 1964).

The Crooks Gap Conglomerate was named by Love (1970) and refers to the large granite boulders embedded in pink to gray arkosic sandstone and siltstone found almost exclusively on Crooks Mountain and Green Mountain. This Eocene-age conglomerate unconformably overlies the Battle Spring and Wasatch formations and was interpreted by Love as occurring on the north side of Sheep Mountain.

The Eocene-age Battle Spring Formation is the principal ore-bearing rock within the Project Area and is the stratigraphic equivalent to the Wind River Formation north of the Granite Mountains. Generally, the Battle Spring Formation is characterized as a high energy fluvial deposit with discontinuous interbeds of conglomerate, arkosic sandstone, siltstone, and mudstone (Pipiringos, 1955). Thickness within the Great Divide Basin ranges from 1,000 to 4,500 feet (Welder and McGreevy, 1966). The Battle Spring is split into an upper (B) member and lower (A) member. The upper member contains conglomeratic and arkosic sandstone with granitic detritus and becomes finer grained to the south. The lower member contains increasingly large amounts of sedimentary detritus and coarsening northward conglomerates (Stephens, 1964). Uranium mineralization in the form of uraninite is typically found within the A member and is described in Section 3.2.3.1, below. Because of varying topography and structure, the Battle Spring Formation ranges from 0 to 2,000 feet thick within the Project Area (800 feet in the Congo Pit and 2,000 feet under Sheep Mountain).

The Battle Spring Formation intertongues with all of the subdivisions of the Wasatch Formation (Pipiringos, 1955). The two are often grouped together, but the Battle Spring is considered a mountain-ward fluviatile facies of the main body of the Wasatch Formation (Mason and Miller, 2005).

The Wasatch Formation is split into many different subdivisions including the Red Desert, Niland, New Fork, Cathedral Bluff, and Desertion Point Tongues and is commonly characterized by red-colored fluviatile rocks of early Eocene age (Sullivan, 1980). The Wasatch Formation is conformably underlain by the Fort Union throughout most of the Great Divide Basin, and the two are often indiscernible in vertical section, except on the basin margins where the Wasatch Formation is incompletely represented (Sullivan, 1980).

The Paleocene-age Fort Union Formation unconformably underlies the Battle Spring Formation in the Crooks Gap area, except where absent (Stephens, 1964). The Fort Union Formation consists of lenticular white to brown sandstone, conglomerate, shale, and siltstone and can be up to 800 feet thick (Keefer, 1965).

Late Cretaceous-age sedimentary rocks within the Great Divide and Wind River basins include: the Lance Formation, Lewis Shale, Mesaverde Formation, and Cody Shale (Love, 1970). In the Granite Mountains area, the Lance Formation, Lewis Shale, and Mesaverde Formation were eroded away prior to deposition of Tertiary-age rocks leaving the Cody Shale behind. The Cretaceous Cody Shale consists of dark gray, limy, marine shale that is sandy in the upper half with some thin sandstone and bentonite beds (Love, 1970). The Cody Shale creates a low permeable layer that impedes groundwater flow and is part of the Baxter-Mowry confining unit as described by Mason and Miller (2005).

Structural Features Structural features in the Sheep Mountain area include a series of northwest trending asymmetric anticlines composed of Paleozoic and Mesozoic rocks, faults associated with the uplift and subsidence of the Granite Mountains, an east trending zone of normal faults, and several thrust sheets at the northern edge of Crooks Mountain and Green Mountain (see Map 3.2-4).

Folds. Four northwest trending asymmetric anticlines composed of Paleozoic and Mesozoic rocks create an angular unconformity between the Tertiary rocks in the Sheep Mountain area. The southwest limb of each structure tends to be cut by a high angle reverse fault and has a much steeper angle than the opposing limb.

The Sheep Creek anticline is the furthest east of these structures and is about 1-mile wide and 3-miles long. The southwest flank dips as steeply as 75 degrees overturned and the northeast flank dips up to 41 degrees. The Spring Creek Anticline exposes the Cody Shale just north of Sheep Mountain and extends southeastward under the mountain. The Crooks Gap Anticline plunges beneath Eocene-age rocks just north of Crooks Peak. South Happy Spring Anticline is the furthest west of the four features and is similar in orientation and dimensions, but the anticline plunges beneath Crooks Mountain (Stephens, 1964).

The North Happy Springs anticline is to the north and west of the four asymmetric faults and appears to trend east-west, parallel to the Kirk Normal Fault. A reverse fault on the north side of the anticline repeats the Mesozoic rocks that later became displaced through normal faulting (Stephens, 1964).

Faults. The South Granite Mountain fault system is counterpart to the North Granite Mountain fault system that together bound the Granite Mountains and Sweetwater Plateau. Movement along this fault occurred during the early Eocene when the Granite Mountains were uplifted. Upward vertical displacement associated with this initial faulting was as much as 3,000 feet (Love, 1970). Later, during middle Eocene time, the Granite Mountains subsided into the Split Rock Syncline and the South Granite Mountain fault system and recorded at least 2,000 feet of downward vertical displacement (Love, 1970).

The Kirk normal fault is a branch of the South Granite Mountain fault system. This fault is recognized as an irregularly curved, eastward extending normal fault that creates an abrupt break in topography where Crooks Peak yields to the low-angle Sweetwater River Valley. Surficial evidence indicates that the south side of this fault is down-dropped. North of Crooks Mountain, the Battle Spring Formation contacts nearly vertical sandstone beds of the Split Rock

Formation and displacement was estimated at 2,250 feet (Love, 1970). Faulting along the Kirk normal fault was considered to occur during the middle-Miocene through the Pliocene (Stephens, 1964).

Just to the north of Sheep Mountain along the Crooks Creek drainage, the Kirk normal fault splits and the southern branch, named the East Kirk normal fault, continues to the southeast (Map 3.2-4). The amount of displacement along this fault is unknown because of the lack of exposure, but the break between Green Mountain and the Sweetwater River Valley juxtaposes the Mesozoic and Paleozoic rocks of the Sheep Creek anticline with Precambrian granite.

The Emigrant Trail thrust fault is a low angle subsurface fault that is approximately 50 miles long and runs from the Beaver Rim southeast to Crooks Gap where it intersects the Kirk normal fault. Displacement associated with this fault can be as much as 15,000 in the Granite Mountains.

The Sheep Mountain area is dissected by shallow normal faults within Member A of the Battle Spring Formation as visible within walls from historic mine workings; however, movement is thought to have occurred during the Eocene with a maximum offset of 50 feet (Stephens, 1964).

Thrust Sheets. Two major thrust sheets that are bounded by thrust faults have been identified by Stephens (1964) in the northern part of T. 28 N., R. 92 W. (Map 3.2-4). The larger of the two thrust sheets, the Granite Mountains thrust sheet, represents a displaced structural block from the main mass of the Granite Mountains to the northeast and is bounded to the southwest by the Emigrant Trail thrust. One test hole drilled to the northwest of the visible thrust sheet penetrated 1,230 feet of Tertiary rocks and 1,800 feet of granite before hitting overturned Paleozoic and Mesozoic rocks (Stephens, 1964).

Another, separate thrust sheet was identified by Stephens (1964) to the north of Crooks Mountain called the Happy Springs thrust sheet and can only be shown in wells where the Frontier Formation repeats. Presumably, the Granite Mountains thrust sheet overrode the Paleozoic and Mesozoic rocks that make up the Happy Springs thrust sheet during southward movement along the Emigrant Trail thrust fault.

Geologic History. Geology within the Crooks Gap and Granite Mountains area was largely influenced by the Late Cretaceous and Early Eocene Laramide Orogeny (Love, 1970). In order to understand the geology and uranium deposition within Crooks Gap, the geologic history of the Granite Mountains must be understood. Deposition and uplift of the Granite Mountains occurred in sequences beginning in the Late Cretaceous.

Uplift of the Granite Mountains began during the Late Cretaceous while the Wind River Basin to the north and the Great Divide Basin to the south sank in a nearly parallel orientation. This event eroded the Lewis Shale and Mesaverde Formation from the Granite Mountains area and deposited the Lance Formation in the surrounding basins (Love, 1970).

During Paleocene time, the magnitude of uplift in the Granite Mountains increased while the subsidence of the flanking basins decreased. Erosion stripped the Lance Formation from the banks of the Granite Mountains into the Great Divide and Wind River basins. Erosion and deposition kept the sinking basins approximately at sea level where lakes and coal swamps developed the Fort Union Formation (Love, 1970).

The next phase of the Granite Mountains uplift (early Eocene) was the most severe, and a high concentration of folding and faulting ensued. Compressional forces in the southwest direction developed major low-angle thrusts and reverse faults. Anticlines and small thrusts formed on the north and south flanks of the Granite Mountains and created the southwest trending Sheep Creek, Spring Creek, Crooks Gap, and South Happy Springs Anticline (Love, 1970).

Increased uplift created northeast flowing and southwest flowing drainage systems. The northeast drainage flowed into the Wind River Basin, and through a series of violent uplifts deposited large arkosic fans in the vicinity of the Granite Mountains that make up the lower part of the Wind River Formation. The southwest drainage flowed into the Great Divide Basin in a similar fashion, and the Battle Spring and Wasatch formations were deposited as large coarse-grained arkosic fans on the margins of the coal-swamps that occupied the basin at the time. The majority of uranium deposits found within the Great Divide Basin are found in these arkosic fans. Violent uplifting and faulting persisted during the early Eocene, and Precambrian rocks overrode Mesozoic and Paleozoic rocks creating the two major thrust sheets in the Crooks Gap area (Love, 1970).

For a few million years following rapid upheaval, the Granite Mountains were relatively stable and regional subsidence in Wyoming allowed deposition of the Green River Formation where oil shale and tar sand deposits can be found today (Pipiringos, 1955).

Between early and middle Eocene, the Granite Mountains rose up to 5,000 additional feet along the east-west trending North and South Granite Mountain fault systems. This uplift deposited the giant boulders found within the Crooks Gap Conglomerate. Boulders within the upper part of the Wind River Formation deposited during this time comprise the uranium host rock in the Gas Hills (Soister, 1968).

For the next 20 million years that make up the late Eocene, the Granite Mountains were relatively stable, and the Wind River Basin filled with sediment. Volcanic activity in the Rattlesnake Hills added to the deposition of the surrounding basins as evidenced within the Wagon Bed Formation. Drainage through the Wind River Basin was blocked to the north and east, and several fresh-water lakes occupied the region. A local uplift in the southern portion of the Wind River Mountains led to the deposition of conglomeratic fans within the Great Divide Basin that make up the Ice Point Conglomerate (Love, 1970).

Large amounts of volcanic debris sourced from the Absaroka volcanic area was deposited by a powerful river into the Great Divide Basin and western Granite Mountains. This river is thought to have begun in the late Eocene and continued throughout the Oligocene. The White River Formation is the depositional result of this prehistoric river. The Oligocene was a markedly drier climate than the late Eocene and sediments within the White River Formation reflect this change (Love, 1970).

Rapid deposition and basin fill during the late Eocene and Oligocene led to subsidence of the Granite Mountains during the Miocene which accelerated burial rates. The Miocene marks the deposition of tuffaceous sandstone beds within the Split Rock Formation and Moonstone Formation. The tuffaceous sandstone deposits contain high concentrations of thorium and uranium that are thought to have been sourced from the Yellowstone National Park region (Love, 1970). During the Late Pliocene or Early Pleistocene, the Granite Mountain fault block subsided with the reactivation of the North and South Granite Mountain fault complexes. Synchronously, the Great Divide and Wind River basins became elevated with epeirogenic uplift. This allowed the establishment of the North Platte and Sweetwater River drainages while forcing the Wind River to re-excavate the Wind River Basin and flow to the north (Van Houten, 1964).

Further subsidence of the western portion of the Granite Mountains from Pleistocene to recent tilted the strata of the Sweetwater Plateau slightly southward. This tilt halted the flow of northward flowing streams such as Crooks Creek and Sheep Creek and allowed groundwater containing dissolved uranium to flow southwards and accumulate along fault boundaries or other such barriers. The Green Mountain and Crooks Mountain lineament was most likely formed during this time either as a process of headward erosion or superimposition by Crooks Creek (Love, 1970).

Uranium Mineralogy and Occurrence. The Project Area overlaps the Crooks Gap/Green Mountain Mining district which is a highly productive mining district with the majority of the most productive mines occurring within the Project Area. It is estimated that 20 million pounds of U_3O_8 or yellowcake has been mined from within the Sheep Mountain Project Area. The uranium host rock within the Project Area consists of coarse-grained medium to light gray arkosic sandstones within the A Member of the Battle Spring Formation, and ore is found to principally mineralize as uraninite and coffinite. Some deposits of schroeckingerite are also known to contain uranium with a major accessory mineral of pyrite (Love, 1970). Uranophane, autonite, and uraninite often visibly characterize ore deposits, but ore can also show no visible uranium minerals. Additional mineralization has been found within carbonaceous sediments of the lower part of the A member. Sediments in the Battle Spring Formation contain from 0.0005 to 0.001 percent uranium (Mason and Miller, 2005). Ore grade and thickness vary depending on the mineralization, environment, and lithology. Typically ore thickness varies from 50 to 200 feet along strike, 5 to 8 feet in height, and 20 to 100 feet in width (Roscoe Postle Associates, Inc. - RPA, 2006).

Uranium deposition in the Granite Mountains area is found in several different environments. Typically, uranium within the Wind River Formation north of the Granite Mountains is found in roll-front or redox-front deposition, while uranium in the A member of the Battle Spring Formation accumulates in a wide variety of environments including: channelized roll-front deposition, deep-trend deposition, and ravine deposition (RPA, 2006). Groundwater plays an important role in uranium accumulation within the Granite Mountains area (Stephens, 1964), but the source material for uranium mineralization is somewhat controversial.

Love (1970) and Stephens (1964) agree that uranium precipitates from groundwater in a reducing environment within arkosic and carbonaceous rocks as evidenced by the roll-front style pattern that characterizes the ore-zones in the Gas Hills and Crooks Gap areas. The origin of the uranium deposits in the Granite Mountains area, including Crooks Gap and the Gas Hills, has been attributed to three different hypotheses. One potential source for uranium involves leaching into the porous Wind River and Battle Spring formations from the overlying uraniferous tuffaceous volcanic rocks of the Moonstone and Split Rock formations. Another hypothesis suggests that granitic sediments within the Battle Spring and Wind River formations leached uranium deposits internally. This hypothesis is supported by the relatively high concentrations of uranium within the source granite of the Granite Mountains. Stephens (1964) suggested that uranium within the Crooks Gap area is the result of hydrothermal alteration from a deep primary source of uranium-bearing water as supported by the accumulation of uranium near faults. Love (1970) believed that uranium bearing groundwater would precipitate near faults because they act as a structural barrier where accumulation is made possible. In general, the high concentrations of uranium within the Granite Mountains area could be a product of a combination of different depositional environments.

3.2.2.3 Geological Hazards

Overburden Characteristics. Energy Fuels conducted sampling and analysis of overburden (waste rock) material at the Congo Pit area to identify the potential for this material to become hazardous during storage or upon reclamation (WDEQ, 2015a). Overburden material at the Congo Pit area is composed of Quaternary aged Alluvium and weathered material from the uranium host rock Battle Spring Formation. Analysis of overburden by Energy Fuels was aimed at identifying the presence of potential hazards such as high radiological or metal concentrations and acid formation and comparing these concentrations to the WDEQ-LQD suitability guidelines for overburden and topsoil (WDEQ, 1994). Particular hazards of concern that were further evaluated consist of: radium-226, radon-222, sodium adsorption ratios (SARs), boron, acid base potential, selenium, and molybdenum.

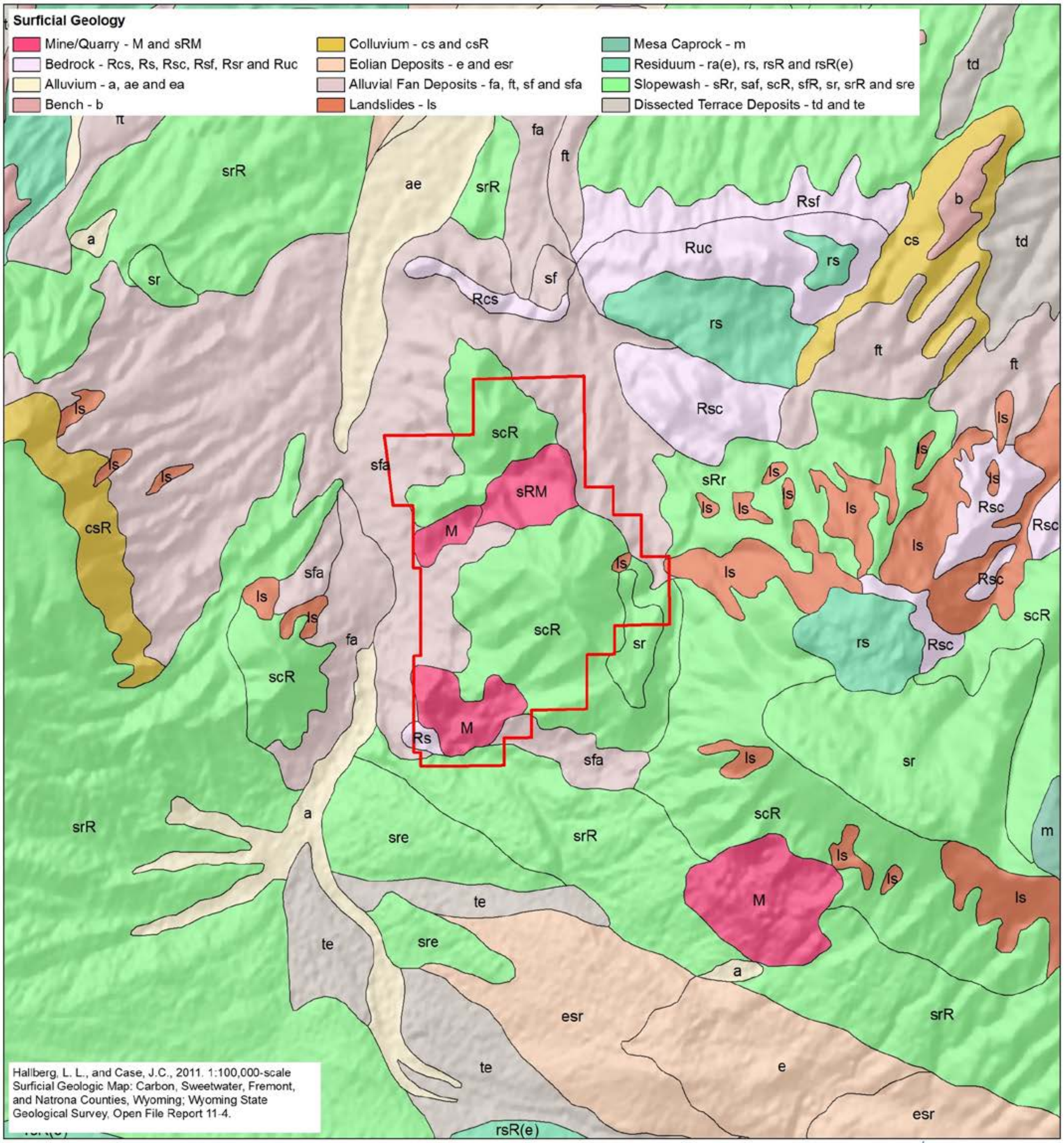
Energy Fuels found during their analysis that ore zones are typically high in radiological and metal concentrations while non-ore zones nearer the surface have much lower concentrations. This is similarly the case for selenium and magnesium concentrations. Selenium concentrations as high as 1.53 ppm were identified in drillholes within ore zones at the Congo Pit, and concentrations in non-ore zones did not exceed 0.3 ppm. Molybdenum levels were as high as 27.3 ppm within ore zones. Boron concentrations exceeding 5 ppm were identified in overburden in one drillhole at the Congo Pit. Low pH levels (<5.5) and marginal SARs (>10) are identified within ore zones. Acid base potentials between -0.12 and -7.59 (calcium carbonate - $CaCO_3$ equivalent/1,000 tons) were mostly identified within ore zones and contained an average pH of 5.4 (WDEQ, 2015a).

Seismology. Engineering Analytics (2013) performed a seismic hazard analysis that included a historic review of earthquakes within a 200 mile radius of the Project Area as of July, 2011. The analysis evaluated ground motion related to faults, background earthquake events, and a summary of short-term and long-term ground motions from specified probabilities of exceedance. According to the analysis, nine potentially active faults were identified near the Project Area, and the Green Mountain segment of the South Granite Mountain Fault system produced the largest peak ground acceleration (PGA) at 0.94g, where g is equal to the acceleration due to gravity or 9.8 meters per square second (m/s^2). Based on probabilistic analyses, the mean PGAs for the 2,500-year and 10,000-year return periods were estimated to be 0.16g and 0.58g, respectively, for the analysis area. Maps prepared by the USGS place the Project Area at 0.21g with a 10 percent probability of exceedance in 50 years (USGS, 2008). The Uniform Building Code (UBC, 1997) Seismic Zone Map shows the Project Area in Seismic Zone 1 based on a conservative PGA of 0.1g.

The overall potential for seismic activity in the regional vicinity of the Project Area is low (Case, 1997). The largest recorded earthquake within the analysis area (179 miles away) occurred November 8, 1882 west of Fort Collins, Colorado as a magnitude 6.6; however, more than 80 percent of the earthquakes within the analysis area had magnitudes less than 5.0 (Engineering Analytics, 2013). The Green Mountain segment of the South Granite Mountain Fault system has the highest potential for earthquakes in the immediate vicinity of the Project Area and could generate a 6.75 magnitude earthquake recurring every 2,000 to 6,000 years (USGS, 2010a). As of December 2010, the closest historic event, located approximately 9 miles east of the site, occurred on December 11, 1996, and had a magnitude of 3.4 (Engineering Analytics, 2013; USGS, 2010a).

Landslides. One relatively small landslide has been mapped on steep slopes of Sheep Mountain towards Sheep Creek (Map 3.2-5) (Hallberg and Case, 2011). This landslide is classified as a multiple debris/earth flow or slide. Landslides are known to occur on the northern flanks of Green Mountain as debris flows/slides and Crooks Mountain to the east as Quaternary alluvial fans. These slides usually consist of arkosic debris and Mesozoic rock fragments in an argillaceous matrix. Within the vicinity, landslides generally occur on steep slopes at the contact between arkose of the Battle Spring Formation and the Cody Shale.

Karsts. The majority of the Project Area overlies what is classified by the USGS as fissures, tubes, and caves over 1,000 feet long, 50 to 250 feet vertical extent; in moderately steeply dipping beds of carbonate rock. This classification is based off of seismic data and gravity anomaly interpretations and possibly reflects the underground workings associated with historic mining efforts at Sheep Mountain (USGS, 2001). No caves subject to protection under the Federal Caves Protection Act of 1988 have been identified.



Map 3.2-5
Surficial Geology

Sheep Mountain Project Area

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3.2.3 Mineral Resources

Although uranium is the primary mineral resource underlying the Project Area, other mineral resources occur in the region including: oil, gas, coal, bentonite, jade, sand, gravel, and other minerals (Hausel et al., 1979). Bentonite and uranium are managed as locatable minerals subject to the 43 CFR § 3809 regulations. Oil and gas (including coal bed methane) are managed in accordance with the Mineral Leasing Act of 1920 as amended. Mineral materials such as sand and gravel are subject to the Materials Act of 1947. No geothermal resources in the Project Area have been identified as commercially viable for leasing subject to the Geothermal Programmatic Record of Decision of 2008 or solid mineral leasables.

3.2.3.1 Locatable Minerals

Uranium deposits are known to occur in four major districts in Wyoming with the dominant source material coming from Precambrian granites of the Granite Mountains (Love, 1970). The Great Divide and Wind River basins both contain significant uranium deposits sourced from the Granite Mountains and found within the Wasatch and Battle Spring formations (Stephens, 1964). Uranium projects in the Gas Hills and Lost Creek permitted to utilize ISR to mine uranium. Energy Fuels estimates the mineral resource at Sheep Mountain to be in excess of 30 million pounds of uranium with an average grade of 0.111 percent U_3O_8 or yellowcake.

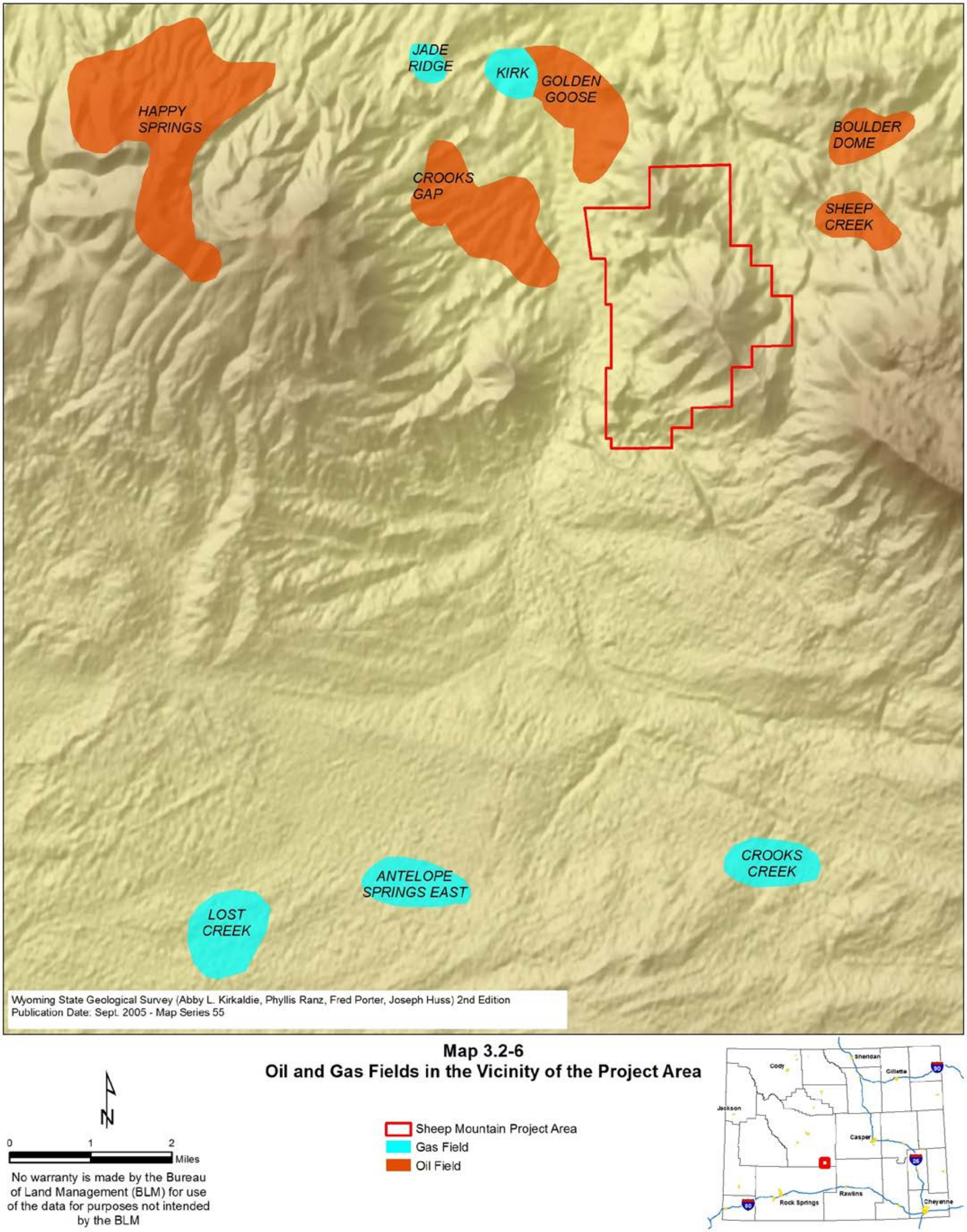
Nephrite jade is a specialty stone found in the Granite Mountains area within boulders and veins of Precambrian rocks. Green and black shades of jade have been collected in Wyoming since the 1930's, and the largest tonnage has come from the Crooks Gap area from boulders in the Wasatch and Battle Spring formations (some greater than 3,000 pounds) (Hausel et al., 1979; Love, 1970). The most valuable jade is apple green in color and was mineralized from hydrothermal waters during the Granite Mountains uplift and subsequent faulting (Love, 1970). No investigations have been conducted concerning the economic viability of jade within or adjacent to the Project Area.

Outcrops of the bentonite bearing Cretaceous Shales occur at the northern edge of the Project Area and cover approximately 1 square mile (Knechtel and Patterson, 1956). Bentonite is a locatable mineral and is generally mined throughout Wyoming from outcrops of the Cretaceous Cloverly, Thermopolis, Mowry, Frontier, and Cody shales. The primary mineral constituent of bentonite in Wyoming is the clay montmorillonite but often contains clinoptilolite, phillipsite, mica, gypsum, and other less valuable minerals. No investigations have been conducted concerning the economic viability of the bentonite-bearing formations near the Project Area.

Gypsum, zeolite, pumicite, and vermiculite are commonly viable minerals that occur in outcrops near the Project Area but have never been mined and are not considered to be economic in this area. Thorium and vanadium are economically valuable constituents often found accessory to uranium, but do not occur in valuable quantities within the Project Area (Love, 1970).

3.2.3.2 Leasable Minerals

Leasable minerals in the region of the Project Area include oil, gas, and coal. Producing oil and gas fields/units in the immediate vicinity of the Project Area include: Happy Springs, Crooks Gap, Sheep Creek, Crooks Creek, Golden Goose, Boulder Dome, Jade Ridge, Antelope Springs East, Lost Creek, and Kirk (gas storage agreement site) (Map 3.2-6). Production history of these fields is listed in Table 3.2-7. These fields typically produce from structural traps related to the anticlinal complex formed by early Eocene uplift along the Emigrant Trail Thrust where Fort Union and younger strata unconformably overlap the Cody Shale or older rocks (Love, 1970).



Map 3.2-6
Oil and Gas Fields in the Vicinity of the Project Area

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Table 3.2-7
Oil and Gas Field Production History

Field	Location	Discovery Year	Total Wells	Producing Wells	Idle Wells	2012 Oil BBLS	2012 Gas MCF	Total Cumulative Oil BBLS	Total Cumulative Gas MCF
Happy Springs	T28N R93W	1950	30	27	3	9,530	27,034	9,175,610	11,071,958
Crooks Gap	T28N R92, 93W	1944	15	14	1	9,420	0	13,497,576	1,362,402
Sheep Creek	T29N R92W	1935	7	6	1	3,254	0	347,137	0
Crooks Creek	27N 92W	1991	2	0	2	0	0	0	135,148
Golden Goose	28N 92W	1966	9	6	1	1,900	0	984,272	156,153
Boulder Dome	28N 92W	1984	2	0	0	0	0	11,074	0
Kirk	28N 92W	1954	13	0	0	0	0	935,988 (injected)	0
Jade Ridge	28N 93W	1976	4	0	0	0	0	30,537	965,311
Antelope Springs East	27N 93W	1959	1	0	0	0	0	0	191,081
Lost Creek	27N 93W	1976	3	0	0	0	0	0	32,958

Source: WOGCC, 2013.

Only one oil and gas well has been drilled within the Project Area (NESE Section 21 T28N, R92W); it was determined to be dry and subsequently abandoned and capped in 1959 (Wyoming Oil and Gas Conservation Commission - WOGCC, 2013). The Found Soldier Unit is not a proven field but overlaps the southern and eastern boundary of the Project Area in Sections 27 and 33, T28N, R92W.

Coal bed methane potential in the vicinity of the Project Area is moderate to the south, within the Green River Coal Field, and low to very low within the Project Area (Hausel et al., 1979).

Coal reserves have been identified in beds of the Wasatch Formation throughout the Great Divide Basin and represent the Green River Coal Region. Coal in the northern part of the Great Divide Basin has been largely uninvestigated, but Love (1970) conservatively estimated the amount of un-described coal in this region to be greater than 1 billion tons. There have been no activities associated with coal leasing in the Lander Field Office planning area within the last 70 years and the NOI for the RMP revision (BLM, 2007) did not contain a “coal-call” which would generate interest in coal leasing.

3.2.3.3 Mineral Material Disposals

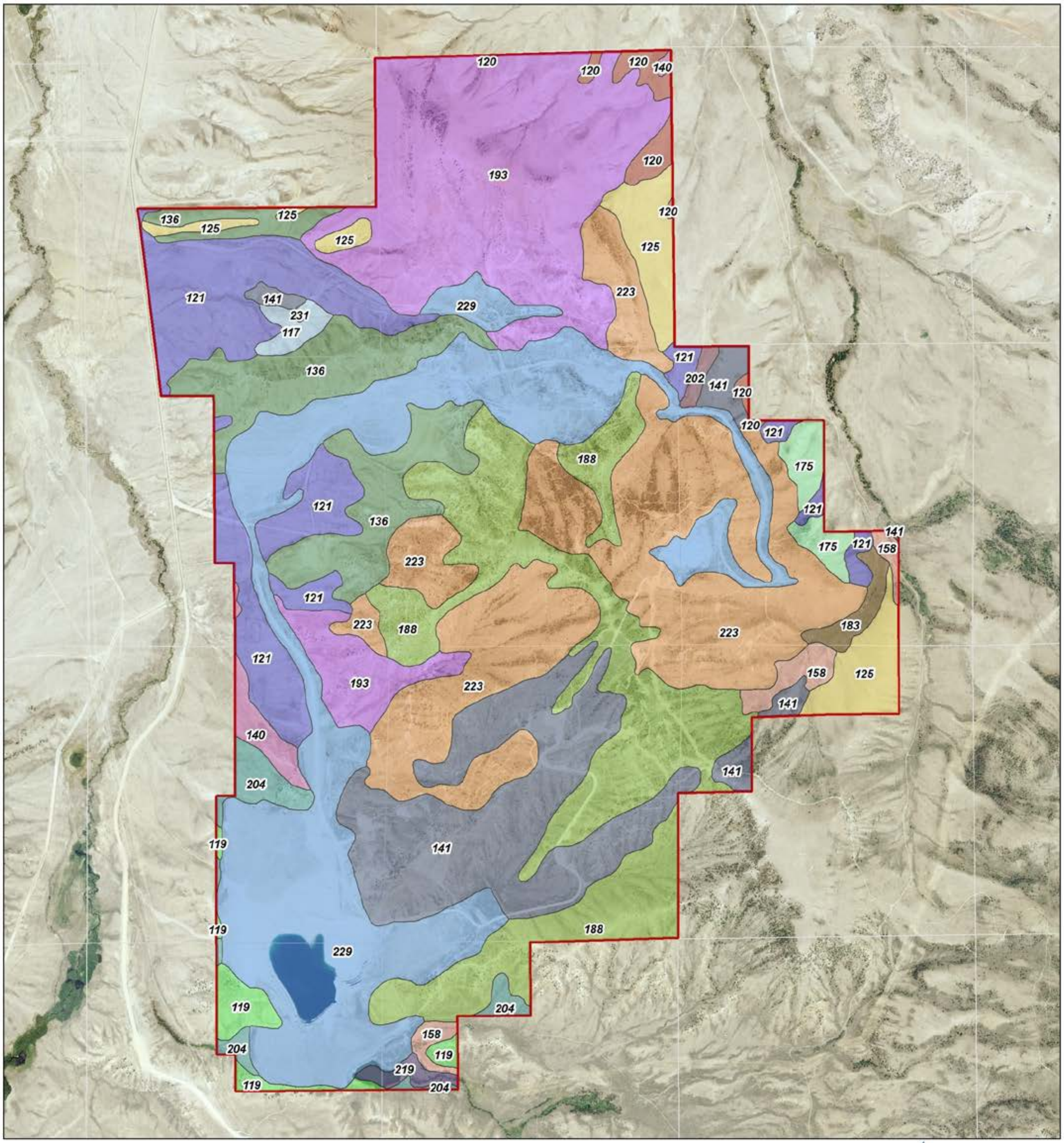
There are currently no active mineral material or salable mineral permits within the Project Area. Sand is plentiful throughout the Sheep Mountain area and Great Divide Basin. The Battle Spring Formation contains abundant arkosic sandstone and can be up to 2,000 feet thick within the Project Area. Active sand dunes to the north and south of the Project Area have been identified but have never been mined (Stephens, 1964). Granite, quartzitic sandstone, chert, and limestone rock fragments make up the gravel deposits found within lenses of all Tertiary rocks in the area including the Battle Spring and Fort Union formations. There are known Limestone deposits to the northeast of the Project Area within exposed Paleozoic and Mesozoic rocks. Additionally, a private gravel sale site is located to the southwest near Happy Springs (SW Section 21 T27 N R93W, 6th P.M., WY, WYW167944), and it is anticipated that 50,000 cubic yards of material is to be removed from the pit. Fremont County has one active Free Use Permit at Jeffrey City (SW Section 3 T29N R92W, 6th P.M., WY, WYW154885) and is currently authorized to remove 130,000 cubic yards of material.

3.2.4 Soils

3.2.4.1 Introduction

In 1983, soils within Fremont County, including the Project Area, were surveyed to an Order 3 scale by the United States Department of Agriculture (USDA), NRCS (2014). The NRCS information is summarized on Map 3.2-7, and the soil map units are described in Section 3.2.4.2. In 1979, to support the Western Nuclear mine permit documents for WDEQ-LQD Permit to Mine 381C, Mine Reclamation Consultants, Inc. completed a soil survey in the Permit Area. The information from this survey is included as Exhibit D-7.1 of Appendix D-7 of the updated Permit to Mine 381C (WDEQ, 2015a). In 2010 and 2013, BKS performed additional soil surveys in the Permit Area, including sampling and mapping of soils and existing topsoil stockpiles (BKS, 2011a and BKS, 2014a). The BKS soil surveys, including topsoil salvage information, are discussed in more detail in Section 3.2.4.3 below and in Appendix D-7 of the Permit to Mine 381C (WDEQ, 2015a). The soil information is summarized on Map 3.2-8. In 2010 and 2011, field investigations were also conducted within the Sheep Mountain Project Area to determine baseline gamma levels and corresponding radium-226 levels. The radiological information is discussed in more detail in Section 3.2.4.4

Generally, the soils in the Project Area are typical of semi-deserts in the western intermountains of the United States and consist of coarse-loamy textures. Rounded hills with moderate to steep slopes make up the topography of the region with elevations ranging between 6,600 feet and 8,000 feet. Sage and grasses sparsely occupy the lower elevations and pine trees inhabit the higher elevations. Due to prevailing climate and vegetation conditions, organic matter is accumulated slowly and is confined primarily to the surface horizon resulting in a light-coloration throughout the profile (BKS, 2011a). Soil depths vary throughout the area, and depth to paralithic material can be from 5 to 60 inches. Most soils within the area were formed in slope alluvium over residuum weathered from sandstone. The susceptibility of the soils within the area to erode through wind and water varies from negligible to moderate based on organic matter content and texture. In general, the Project Area shows relatively high radiological background due to outcropping mineralized zones within the Battle Spring Formation historical mining and exploration activities in the Project Area and vicinity.



Map 3.2-7
NRCS Soils within the Project Area

0 1,000 2,000 3,000 Feet

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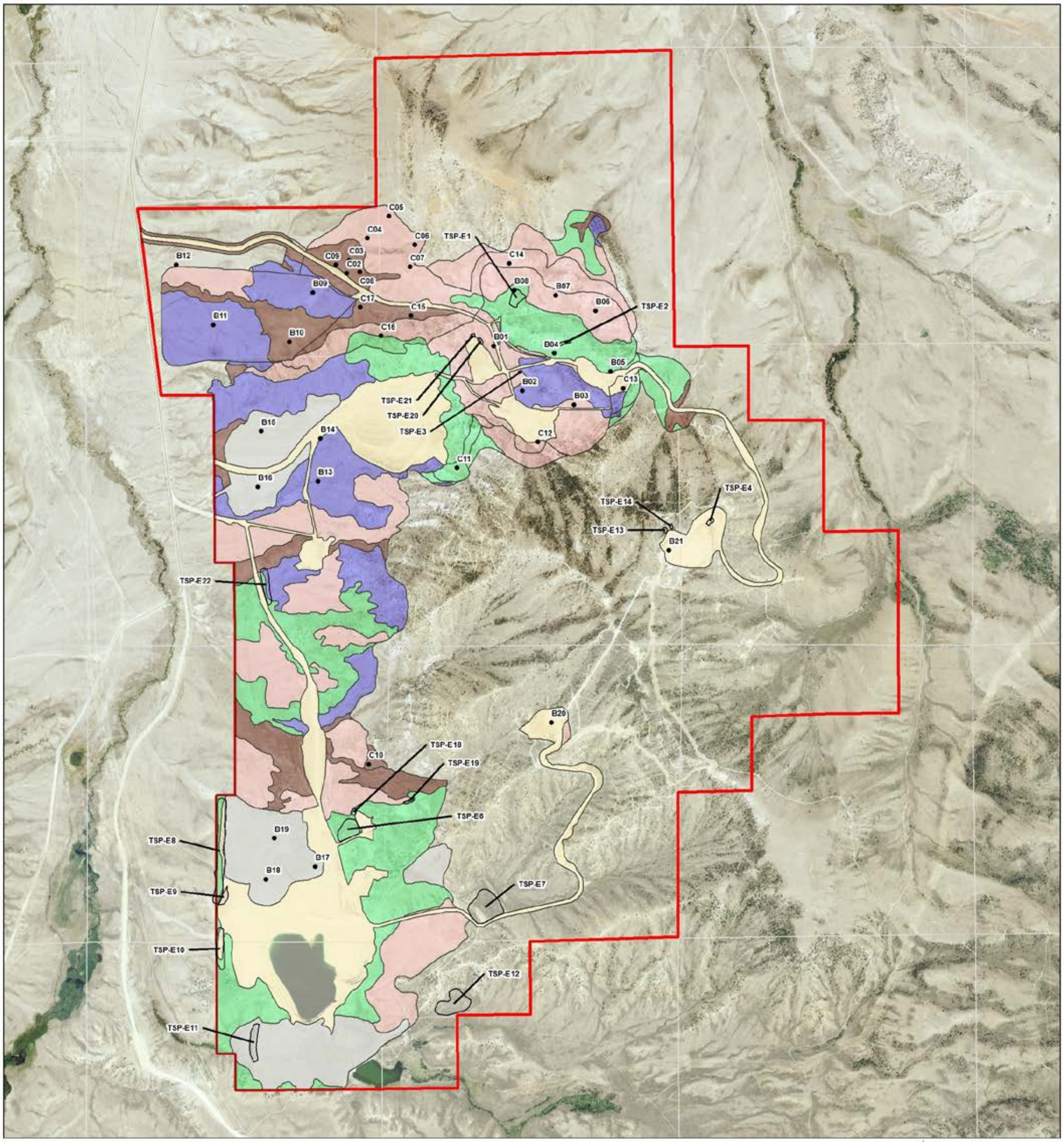
Sheep Mountain Project Area

Soils

117	125	158	193	223
119	136	175	202	229
120	140	183	204	231
121	141	188	219	

Data provided by U.S. Department of Agriculture, Natural Resources Conservation Service



Map 3.2-8
BKS Surveyed Soils within the Project Area

Sheep Mountain Project Area
ExistingTopsoilStockpile
Soil Sample Location

MU Symbol - Soil Map Unit
BO - Bosler
CU - Cushool
D - Disturbance
ON - Onason
ON-RV - Onason/Reclaimed Varient
RO - Rock River

0 1,000 2,000 3,000 Feet

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3.2.4.2 NRCS Soil Map Units

There are 12 NRCS soil map units within the Project Area (see Map 3.2-7). Table 3.2-8 displays the acreage of each map unit, the soil reclamation potential, and the percentage of the map unit within the Project Area. Mapping completed by BKS only occurred within the BKS Sheep Mountain Soil Analysis Area, and did not include descriptions of the entire Project Area; therefore, for consistency in this analysis, the following acres by map unit are based off of NRCS data only.

Table 3.2-8
Soil Mapping Units within the Sheep Mountain Project Area

Map Unit Symbol	Soils Series	Substrate	Soil Reclamation Potential (LRP[1])	Acres	Percentage of Map Unit in Project Area
229	Dumps, Mine	N/A	N/A	677.1	18.6
223	Youga—Quander Complex	Alluvium	Low[b]	631.3	17.5
193	Rockinchair-Rock Outcrop-Sinkson Complex	Residuum Slope Alluvium Alluvium	High	537.5	14.9
188	Quander-Youga-Onason Complex	Alluvium Residuum	High	464.9	12.9
141	Dahlquist-Rock River Complex	Alluvium	High	363.8	10.1
121	Bosler--Ryan Park Fine Sandy Loams	Alluvium	High	302.6	8.4
136	Cragosen-Carmody-Blazon Complex	Residuum Slope Alluvium	Moderate	256.0	7.1
125	Brownsto very boulder – Decross variant –Brownsto Complex	Glaciofluvial Glacial deposits alluvium	High	115.9	3.2
204	Ryark Sandy Loam	Alluvium	High	42.5	1.2
119	Bluerim–Onason Complex	Residuum	High	37.8	1.0
120	Bosler-Rock River Sandy Loams	Alluvium	High	30.9	0.9
158	Havre-Forelle-Glendive Complex	Alluvium	High	35.9	1.0
175	Milvar-Milren Complex	Alluvium	Moderate to Low[a]	35.0	1.0
140	Cushool-Rock River Association	Residuum Slope Alluvium	Moderate	24.8	0.7
117	Blackhall-Carmody Association	Colluvium Alluvium Residuum	Low[a,b]	17.5	0.5
183	Peyton sandy Loam	Alluvium	High	18.8	0.5
219	Venapass-Silas Loams	Alluvium	High	11.9	0.3
202	Ryan Park Loamy Fine Sand	Alluvium	High	6.7	0.2
231	Water	N/A	N/A	0.4	<0.01
			Total	**3,611.3**	**100**

[1] According to the BLM Lander RMP (BLM, 2013a), landscapes that are difficult to revegetate are considered as having a LRP. Landscapes are characterized by highly sensitive and/or erosive soils, with severe physical or chemical limitations, and landforms with steep slopes over 25 percent. Limited physical or chemical factors include high level of salts that interfere with plant growth; soil textures with poor water holding capacity; coarse fragments that limit common practices and equipment; soil profiles that limit water-holding capacity and root zone limitations:

a) Soil textures with poor water holding capacity.
b) Coarse fragments that limit common rehabilitation practices and equipment.

According to the NRCS, generally, soil maps are grouped into units known as soil complex, association, undifferentiated group, or miscellaneous.

- A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps.
- An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps.
- An undifferentiated group is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management.
- Miscellaneous areas have little or no soil material and support little or no vegetation.

Dumps, Mine. This mapping unit occurs as an area of waste rock derived mainly from uranium mine spoils and waste rock material. Mine dump soils are located throughout the entire Project Area and represent the largest percentage of soils mapped.

Youga-Quander Complex. This map unit is composed of Youga loam and Quander cobbly loam and occurs on areas which have 2 to 25 percent slopes, and is formed in alluvium derived from various sources. This complex is located on all aspects of Sheep Mountain. These soils are very deep and well-drained with moderate permeability. The water capacity is moderate to high and effective rooting depth is 60 inches or more. The runoff is medium, hazard for water erosion is moderate, and hazard for wind erosion is slight to moderate. The resistance to dust propagation is moderate and the site degradation susceptibility is slight. Soil compaction resistance is low and the soil restoration potential is low.

Rockinchair-Rock Outcrop-Sinkson Complex. This map unit is composed of Rockinchair fine sandy loam, Rock outcrop, and Sinkson loam and occurs on areas which have 2 to 40 percent slopes. They are formed in residuum, slope alluvium, and mixed alluvium derived from shale interbedded with sandstone, and siltstone. They are located primarily in the northern part of the Project Area on all aspects and on the west aspect of Sheep Mountain. These soils are moderate to very deep and well-drained with a moderate permeability. The water capacity is moderate to high and effective rooting depth is 20 inches or more. The runoff is medium to rapid, hazard for water erosion is moderate to severe, and hazard for wind erosion is moderate to severe. The resistance to dust propagation is moderate and the site degradation susceptibility is moderate. Soil compaction resistance is low and the soil restoration potential is high.

Quander-Youga-Onason Complex. This map unit is composed of Quander cobbly loam, Youga loam, and Onason sandy loam and occurs on areas which have 10 to 45 percent slopes. They are formed in alluvium derived from various sources and residuum and slope alluvium derived dominantly from sandstone. They are located primarily on the ridge top and west aspect of Sheep Mountain. These soils are shallow to very deep and well-drained with a moderate to moderately rapid permeability. The water capacity is low to high and the effective rooting depth is 10 or more inches. The runoff is medium, hazard for water erosion is severe, and the hazard for wind erosion is slight to severe. The resistance to dust propagation is moderate and the site degradation is moderate. Soil compaction resistance is low and the soil restoration potential is high.

Dahlquist-Rock River Complex. This map unit is composed of Dahlquist very cobbly loam and Rock River sandy loam and occurs on areas which have 1 to 12 percent slopes. They are formed in alluvium derived from various sources. They are located primarily on the west and east aspect of Sheep Mountain. These soils are very deep and well-drained with a moderate permeability. The water capacity is low to high and the effective rooting depth is 60 inches or more. The runoff is slow to medium, hazard for water erosion slight, and the hazard for wind erosion is slight to severe. The resistance to dust propagation is moderate and the site degradation is slightly susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Bosler-Ryan Park Fine Sandy Loams. This map unit is composed of Bosler fine sandy loam and Ryan Park fine sandy loam and occurs on areas which have 1 to 8 percent slopes. They are formed in alluvium and eolian deposits derived from various sources. They are located primarily on the western and eastern border of the Project Area. These soils are very deep and well-drained with a moderate to moderately rapid permeability. The water capacity is moderate and the effective rooting depth is 60 inches or more. The runoff is slow, hazard for water erosion is slight, and the hazard for wind erosion is severe. The resistance to dust propagation is moderate and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Cragosen-Carmody-Blazon Complex. This map unit is composed of Cragosen gravelly loam, Carmody gravelly sandy loam, and Blazon sandy clay loam and occurs on areas which have a 6 to 40 percent slope. They are formed in residuum and slope alluvium derived from sandstone, conglomerate, and shale. They are located primarily on the west aspect of Sheep Mountain. These soils are very shallow to moderately deep and well-drained with a moderately slow to moderate permeability. The water capacity is low and the effective rooting depth is 4 to 40 inches. The runoff is rapid, hazard for water erosion is severe, and the hazard for wind erosion is slight to moderate. The resistance to dust propagation is moderate and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is moderate.

Brownsto Very Bouldery-Decross Variant-Brownsto Complex. This map unit is composed of Brownsto very bouldery sandy clay loam, Decross Variant sandy loam, and Brownsto sandy loam and occurs on areas which have a 1 to 50 percent slope. They are formed in glacial deposits, alluvium, and glacial drifts derived from glacial deposits and various other sources. They are located primarily on the east aspect of Sheep Mountain. These soils are very deep and well-drained with a moderate permeability. The water capacity is low to high and the effective rooting depth is 60 inches or more. The runoff speed is slow to medium, the hazard for water erosion is slight to moderate, and the hazard for wind erosion is slight to severe. The resistance to dust propagation is moderate and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Ryark Sandy Loam. This map unit is composed of Ryark sandy loam and occurs on areas which have a slope of 1 to 6 percent. They are formed in alluvium derived dominantly from sandstone and are located primarily in the southwestern part of the Project Area. These soils are very deep and well-drained with a moderately rapid permeability. The water capacity is low and the effective rooting is 60 inches or more. The runoff is slow, hazard for water erosion is slight, and the hazard for wind erosion is severe. The resistance to dust propagation is low and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Bluerim-Onason Complex. This map unit is composed of Bluerim sandy loam and Onason gravelly sandy loam and occurs on areas which have a 3 to 30 percent slope. They are formed in residuum and slope alluvium derived dominantly from sandstone. They are located primarily in the southwestern part of the Project Area. These soils are shallow to moderately deep and well-drained with a moderate to moderately rapid permeability. The water capacity is low and the effective rooting depth is 10 to 40 inches. The runoff is medium, hazard for water erosion is moderate, and the hazard for wind erosion is moderate. The resistance to dust propagation is low and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Bosler-Rock River Sandy Loams. This map unit is composed of Bosler sandy loam and Rock River sandy loam and occurs on areas which have a 1 to 8 percent slope. They are formed in alluvium derived from various sources. They are located primarily in the northeastern part of the Project Area on an east aspect. These soils are very deep and well-drained with a moderate permeability. The water capacity is moderate to high and the effective rooting depth is 60 inches or more. The runoff is slow, hazard for water erosion slight, and the hazard for wind erosion is severe. The resistance to dust propagation is low and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Havre-Forelle-Glendive Complex. This map unit is composed of Havre loam, Forelle loam, and Glendive sandy loam and occurs on areas which have a 0 to 3 percent slope. They are formed in alluvium derived from various sources and are located on the east aspect of Sheep Mountain and the southern part of the Project Area. These soils are very deep and well-drained with a moderately slow to moderately rapid permeability. The water capacity is moderate to high and the effective rooting depth is 60 inches or more. The runoff is slow, hazard for water erosion is slight, and the hazard for wind erosion is moderate to severe. The resistance to dust propagation is low and the site degradation is moderately susceptible. Soil compaction resistance is low and the soil restoration potential is high.

Minor Map Units. Other map units within the Project Area comprising less than 30 acres each consist of the Milvar-Milren Complex, Cushool-Rock River association, Blackhall-Carmody association, Peyton sandy loam, Venapass-Silas loams, Ryan Park loamy fine sand, and water. These units are present within the Project Area, but are not described in detail because they do not occur within the proposed disturbance areas and only occur in minor abundance.

3.2.4.3 BKS Soil Surveys

BKS completed Order 2 soil mapping in August 2010 (BKS, 2011a), with additional areas surveyed in September 2013 (BKS, 2014a). Actual soil boundaries were identified in the field by exposing soil profiles to determine the nature and extent of soil series within the Sheep Mountain Soil Analysis Area. Detailed soil mapping within the proposed disturbance areas was conducted using the same NRCS soil series found within the Project Area. Approximately 1,244.04 acres were surveyed in 2010. An additional 155.91 acres were surveyed in 2013, for a total of 1,399.95 acres surveyed. Over 37 soil profiles were exposed, sampled, and had corresponding profile descriptions written. A total of 16 of those sampled profiles were sent to the laboratory for analysis. Additionally, 11 of the 18 topsoil stockpiles, generally the largest of the stockpiles currently on site from previous disturbances, were sampled in June 2014 to verify viability for use as replacement topsoil.

BKS (2014a) grouped soils proposed for disturbance into five mapping units based on the existing NRCS survey information, but tailored the types to fit the detailed site-specific soil surveys. The five mapping units include Bosler fine sandy loam; Cushool sandy loam; Disturbance; Onason and Onason Reclaimed variant; and Rock River sandy loam (see Table 3.2-9).

The information from the soil surveys was used to determine the areal extent of topsoil and other suitable plant growth medium, and the salvage depths for these materials, and ultimately the replacement depths for these materials over the proposed Project disturbance area (Section 4.2.4). Salvage depths of topsoil suitable as a plant growth medium ranged from less than 0.5 to 1.79 feet (BKS, 2014a), exclusive of previously disturbed areas. Physical factors that limited the soil suitability consisted of low saturation percentages and coarse fragment percentages. Chemical factors that limited soil suitability include electrical conductivity (EC), SARs, and selenium (see Table 3.2-9). According to the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a), approximately 580,000 cubic yards of topsoil would be salvaged during mining operations.

The presence of suitable plant growth medium or coversoil, in addition to topsoil, was also evaluated, and potential salvage thicknesses ranged from about 1.54 to 2.86 feet. Based on these depths, up to 2,000,000 cubic yards of potential salvageable plant growth medium (coversoil) could be salvaged and stockpiled, depending on accessibility and percentage of large rocks and boulders in the material.

Topsoil stockpiles present with the Project Area can also contribute an additional 220,000 cubic yards of topsoil material. Long-term stockpiled topsoil becomes degraded through the alteration/loss of soil structure, increased bulk density, chemical changes, reduced nutrient cycling, reduced microbial activity, and a reduction in viable plant propagules and seed (Storhmayer, 1999). As part of the soil surveys (BKS, 2014a), the viability of the existing topsoil stockpiles were assessed via sampling and testing at the request of the BLM. The only concern noted with respect to the existing stockpiles was that three of the eighteen stockpiles were noted as being very rocky.

Table 3.2-9
Soil Reclamation Potential and Limiting Topsoil Suitability Characteristics

Mapping Unit [1]	Acres within BKS Study Area (%)	Soil Reclamation Potential (LRP[2])	Soil Sampling Results and Limiting Topsoil Suitability Characteristics			
			Suitable Topsoil Salvage Depth[3] (feet)	Coversoil Salvage Depth[3] (feet)	Marginal Parameters	Unsuitable
Bosler (BO) fine sandy loam	158.77 (11.34%)	Low (a, b, d)	1.13	1.99	Saturation, Coarse Fragments	Sodium Absorption Ratio
Cushool (CU) sandy loam	270.27 (19.31%)	Moderate (a, c)	0.47	2.86	Saturation	N/A
Disturbance (D)	337.34 (24.10%)	N/A	Not Available			
Onason (ON) and Onason/Reclaimed Variant (ON-RV)	543.19 (38.80%)	Moderate (a, c)	0.31	2.35	Saturation	N/A
Rock River (RO) sandy loam	90.38 (6.46%)	High (d)	1.79	1.54	Saturation, SAR, EC, Selenium, pH	Sodium Absorption Ratio, pH
Total	**1,399.95**					

[1] Soil mapping units and characteristics are based on BKS (2014a).
[2] According to the BLM Lander RMP (BLM, 2013a), landscapes that are difficult to revegetate are considered as having a LRP. Landscapes are characterized by highly sensitive and/or erosive soils, with severe physical or chemical limitations, and landforms with steep slopes over 25 percent. Limited physical or chemical factors include high level of salts that interfere with plant growth; soil textures with poor water holding capacity; coarse fragments that limit common practices and equipment; soil profiles that limit water-holding capacity and root zone limitations:
a) Soil textures with poor water holding capacity.
b) Coarse fragments that limit common rehabilitation practices and equipment.
c) Soils that have a lithic, paralithic, or other restrictive soil layer within 60 inches of the soil surface. These soils have shallow profiles and hold less available water for plant growth.
d) Soils that are saline or sodic – rating when the conductivity is greater than 8 micromhos per centimeter (mmhos/cm) or the SAR is greater than 12, or both.
[3] The proposed salvage depths are from Appendix B in the BKS report (BKS, 2014a).

3.2.4.4 Radiological Background

In 2010 and 2011, field investigations were conducted within the Sheep Mountain Project Area to determine baseline gamma levels and corresponding radium-226 levels (see Section 3.4.7, Public Health and Safety) in soils on behalf of Energy Fuels (WDEQ, 2015a). The survey better defined the baseline Natural Occurring Radiological Materials (NORM) and Technically Enhanced Naturally Occurring Materials (TENORM). The objectives of the baseline radiological survey and sampling were to:

1. Establish the nature of the pre-mining radiological environment.
2. Detect and document areas having anomalous radiation.
3. Establish pre-mining concentrations of radionuclides in the surface materials of the lands to be affected in order to establish a goal for reclamation.

In general, the Project Area shows relatively high radiological background gamma due to both NORM and TENORM concentrations of radium-226 and other radionuclides in the near surface soils. Elevated NORM is due to outcropping mineralized zones within the Battle Spring Formation. Elevated TENORM reflects the more than 30 years of historical mining and exploration in the Project Area and vicinity.

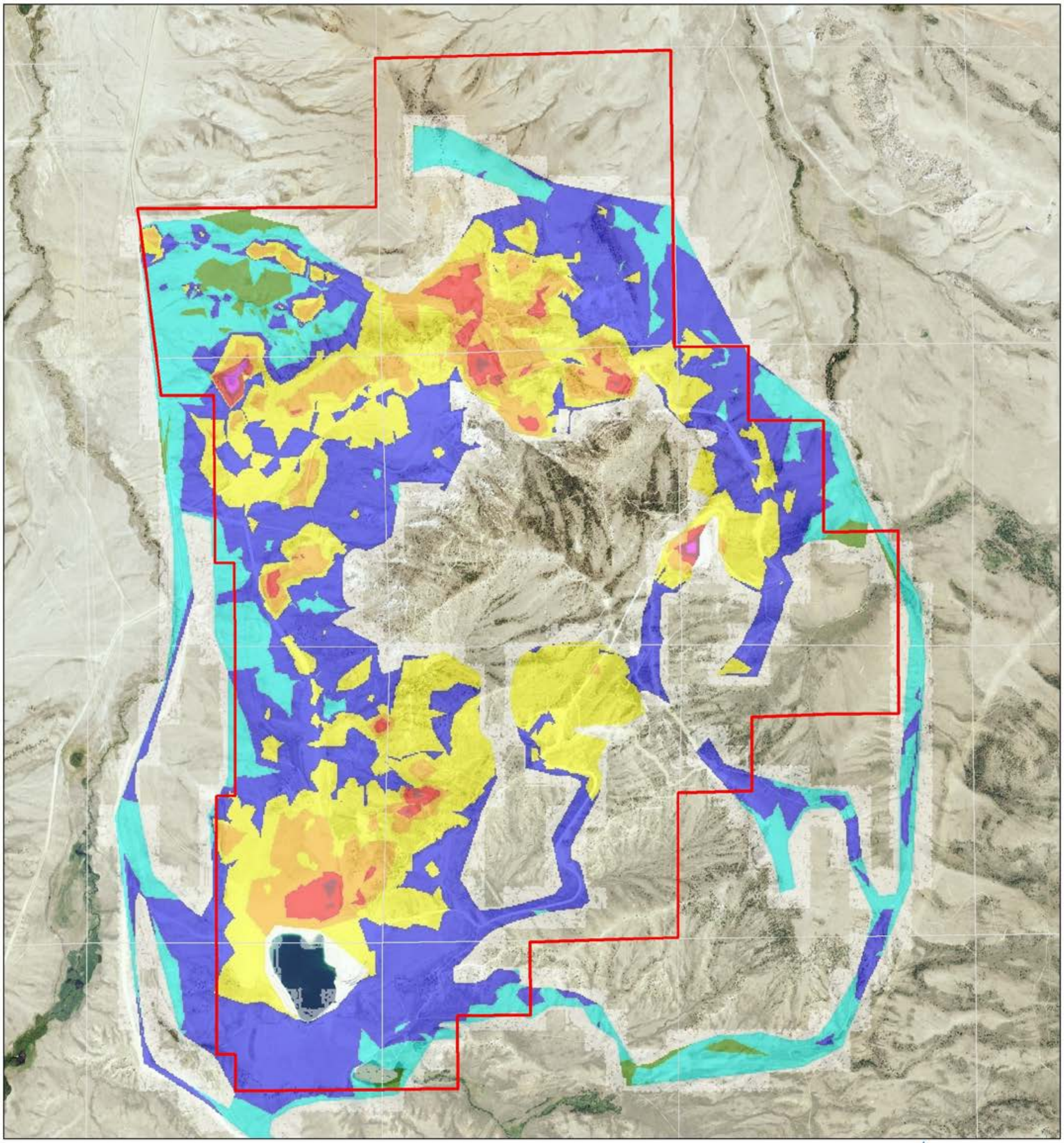
The portions of the Project Area where the surface is underlain by Cody Shale, Fort Union Formation, and/or Quaternary alluvial and colluvial deposits derived from these formations exhibit the lowest background gamma levels and are generally less than 50 microRoentgens per hour (µR/hr). In contrast, areas which are underlain by the Battle Spring Formation and/or Quaternary alluvial and colluvial deposits derived from the Battle Spring Formation exhibit background levels in excess of 50 µR/hr with natural outcrop areas (NORM) exhibiting levels in excess of 75 µR/hr. TENORM levels are related to historic mine operations and may include mine spoils, low grade ore stockpiles, and surface mines. Current existing TENORM levels exceed 150 µR/hr in most cases (WDEQ, 2015a). Soil samples were extracted at locations selected to cover the range of common exposure rates found on-site. The surveyed area had a wide range of exposure rates.

The gamma/radium-226 correlation analysis results demonstrate a strong correlation between radium-226 soils concentration and gamma exposure rate for the soils correlation plots analyzed. Based on these correlations, approximately 70 µR/hr measured in the field would equate to approximately 20 picocuries per gram (pCi/g) radium-226 at the surface.

Exposure rates ranged from 12.9 to 1138 µR/hr, with a standard deviation of 42.3 µR/hr. The survey data are mapped (see Map 3.2-9) to illustrate exposure rate variations seen over the entire site. Gamma exposure rates observed at the soil correlation plot locations ranged between 20.2 µR/hr and 423 µR/hr, with a standard deviation of 128 µR/hr.

3.2.5 Water (Surface, Groundwater, and Water Rights and Water Use)

The location of the Sheep Mountain Project Area is on the divide between the Sweetwater River Drainage (in the North Platte River Drainage system) and the Great Divide Basin (see Map 3.2-10), and the associated topography and geology result in a relatively unusual hydrologic setting, which is described in more detail in the following sections. In particular, surface water flows are generally to the north-northeast into the Sweetwater River Drainage and the groundwater is generally to the west-southwest into the Great Divide Basin.



Map 3.2-9
Surface Gamma Map

Sheep Mountain Project Area

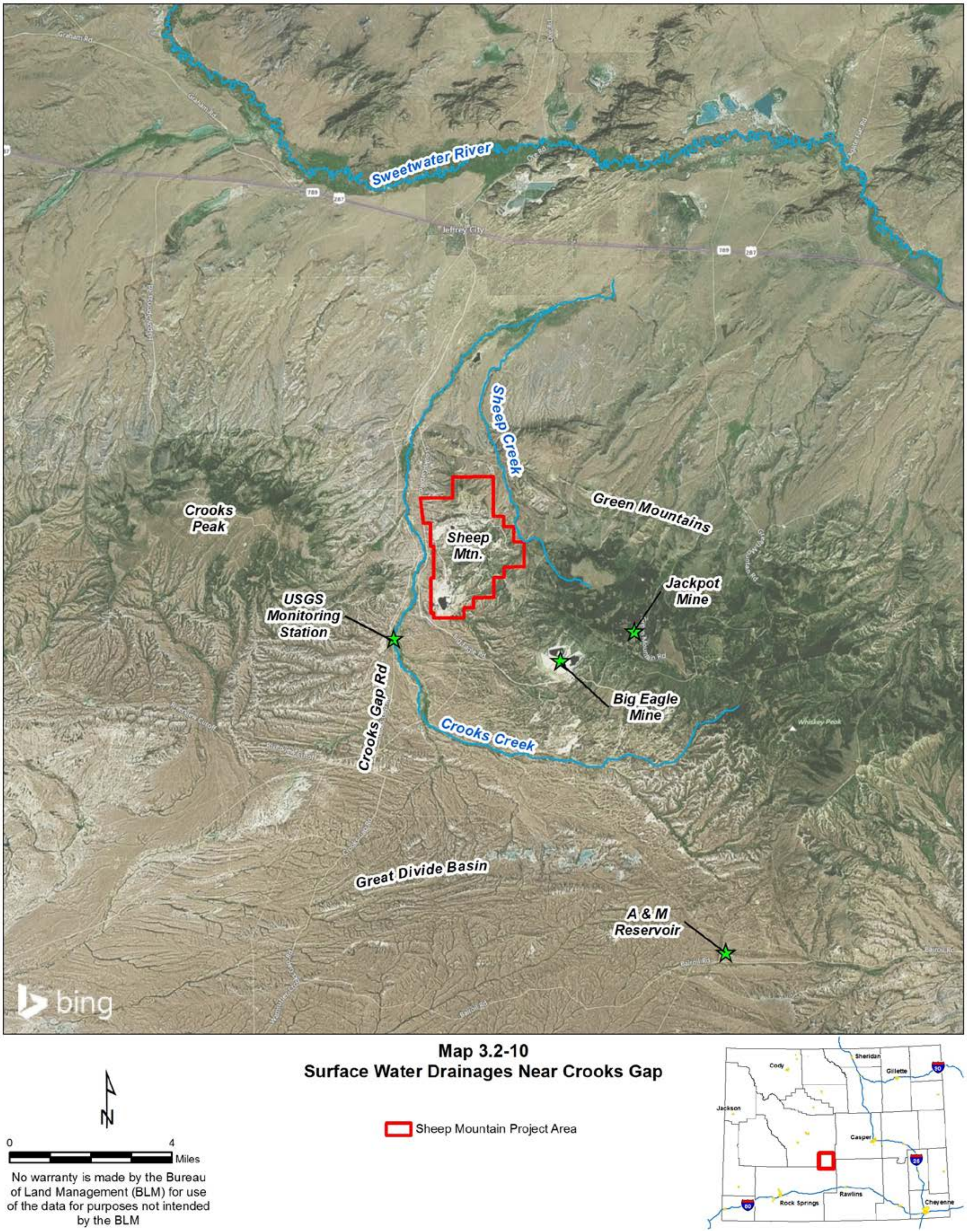
Gamma Exposure Rate (uR/hr)

< 25	50 - 75	300 - 450
25 - 35	75 - 150	450 - 600
35 - 50	150 - 300	600 - 900
		> 900

N

0 1,000 2,000 3,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM



Map 3.2-10
Surface Water Drainages Near Crooks Gap

3.2.5.1 Surface Water

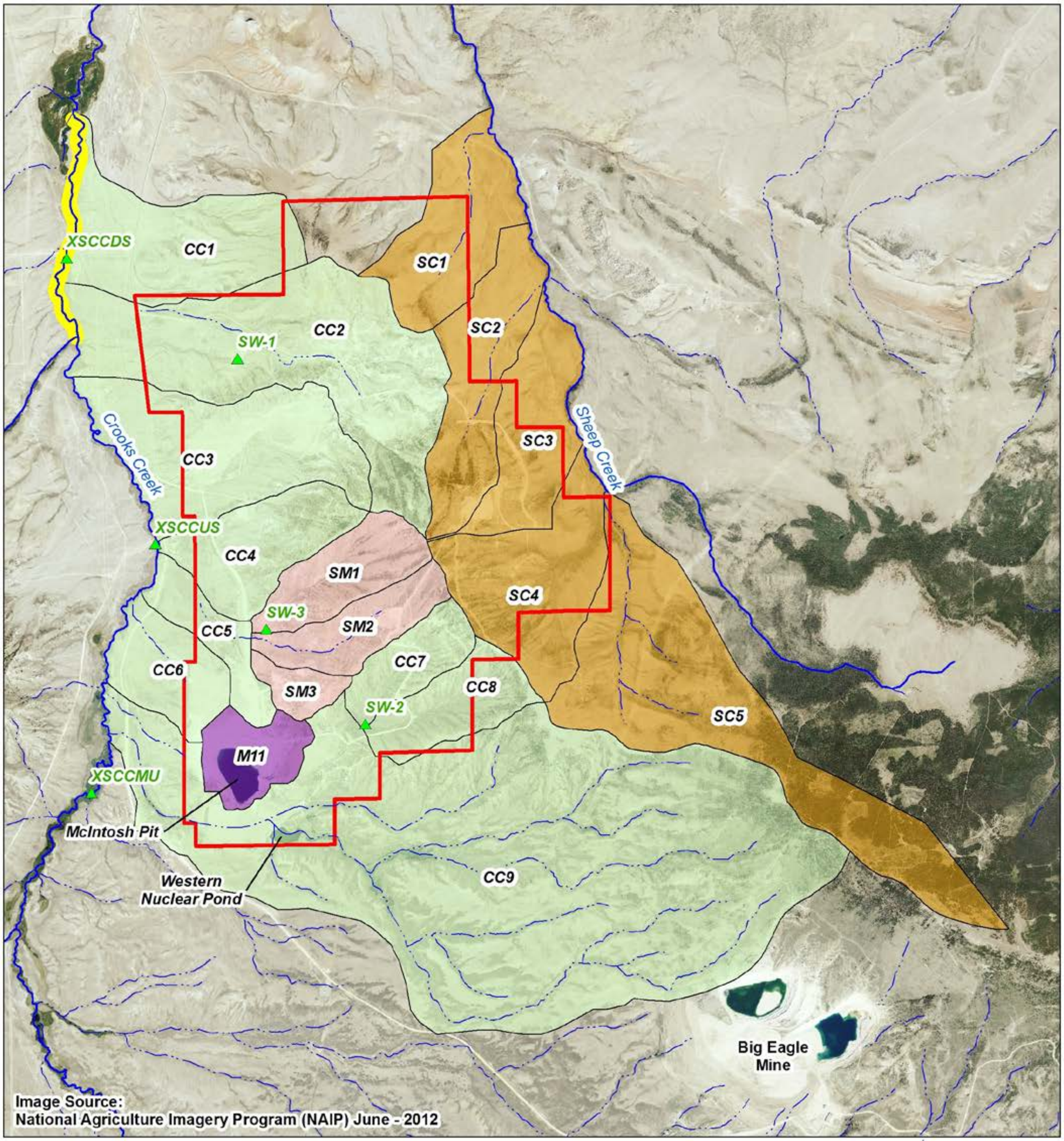
The USGS (2013) places Sheep Mountain within the Sweetwater River Drainage. The Sweetwater River originates in the high mountains of the southern Wind River Range and flows along the southern margin of the Wind River Basin and northern margin of the Great Divide Basin to the Granite Mountains and Devils Gate. The river drains a total of 2,338 square miles (USGS, 2010b). Pathfinder Reservoir, in Natrona County, is where the Sweetwater River joins the North Platte River and flows north. The North Platte River flows approximately 450 miles through Colorado, Wyoming, and Nebraska; and the Sweetwater River is its largest tributary (USGS, 2010b). The North Platte River drainage basin is ultimately part of the greater Missouri-Mississippi River Basin.

All of the surface water flow off the Project Area is ephemeral, and these ephemeral drainages are tributary to two perennial drainages: Crooks Creek to the west of the Project and Sheep Creek to the east of the Project (see Map 3.2-10). The divide between these drainages runs north-south through the Project Area along the top of Sheep Mountain, which roughly coincides with the northeastern edge of the Project Area (see Map 3.2-11). As a result, the majority of site runoff drains to Crooks Creek. Both creeks are within the Sweetwater River Drainage but dissipate before reaching the Sweetwater River (Stephens, 1964).

Two perennial impoundments occur in the Project Area (see Map 3.2-11), the McIntosh Pit and an officially unnamed pond at the south end of the Project Area. The McIntosh Pit was created by mining in the 1970s. The pit receives recharge from groundwater and a minor amount of runoff and precipitation from a very limited catchment area and does not discharge water. The unnamed pond is locally called Western Nuclear Pond (also known as Fish Pond or McIntosh No. 2 Pond) because it was also created during uranium operations by Western Nuclear decades ago. Western Nuclear Pond was created by reclaimed mine overburden material truncating ephemeral drainages to Crooks Creek. The pond receives recharge from runoff and precipitation from a significantly larger catchment area than the McIntosh Pit (Lidstone and Associates, Inc. – Lidstone, 2013), and most of the catchment area above Western Nuclear Pond is also undisturbed. On-going WDEQ-AML work at the McIntosh Pit includes highwall reduction and backfilling the pit above the water table (WDEQ-AML Project 16-O), and at the Western Nuclear Pond includes constructing a low permeability impoundment structure core (WDEQ-AML Project 16-O-2B). As discussed in Sections 2.5 and 5.3.1, Energy Fuels originally had partial responsibility for reclamation of the McIntosh Pit, but to facilitate the more extensive pit reclamation by WDEQ-AML, Energy Fuels turned over the amount of the Permit 381C reclamation bond allocated to that work to WDEQ-AML.

There are also three permitted ephemeral impoundments, SW-1, SW-2, and SW-3, associated with historic mining activities at the site (see Map 3.2-11). These impoundments do not discharge water to the surface. Two of the impoundments, SW-1 and SW-2, are located on ephemeral drainages to Crooks Creek. Impoundment SW-3 intercepts ephemeral drainages to Crooks Creek which were truncated by a road associated with historic mining activities (Lidstone, 2013). Of the eighteen attempts to sample the impoundments between April 2010 and June 2014, the impoundments were dry all but five times for SW-1, all but four times for SW-2, and all but three times for SW-3. One of these impoundments, SW-1, would be removed during construction of the Hanks Draw Spoils Facility and would not be replaced as part of reclamation.

Eighteen ephemeral drainage basins dissect the Project Area (see Map 3.2-11). These drainages are generally steep and well-defined in the higher elevation areas, becoming less channelized in the lower portion. The drainages tend to transport sediment derived from exposed outcrop, local soils, and material uncovered from historic mining activity.



Map 3.2-11
Ephemeral Drainage Basins in the Project Area

N

0 4,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

- Sheep Mountain Project Area
- Crooks Creek Subbasins
- McIntosh Pit Basin
- Sheep Creek Subbasins
- Sheep Mountain Subbasins
- 305b Water Quality - Category 5

Sheep Creek Characteristics

Sheep Creek is a perennial creek that originates just southeast of the Project Area boundary and flows north before joining Crooks Creek and disappearing in sand (see Map 3.2-10). Two small ephemeral tributaries to Sheep Creek originate within the eastern edge of the Project Area boundary along the steep slopes of Sheep Mountain (see Map 3.2-11). Because of the extent of Cody Shale on the east side of the Project Area, no groundwater flow from the Project Area contributes to Sheep Creek (Section 3.2.5.2, below).

Sheep Creek is a low discharge creek (approximately 50 cfs 10 year peak) that does not always flow year-round. The WDEQ-WQD classifies Sheep Creek as Class 2AB (WDEQ, 2013).

Crooks Creek Characteristics

Crooks Creek originates to the south of Green Mountain and flows westward along the base of Green Mountain (Map 3.2-10). South of Crooks Gap, the creek turns northward through the Gap where it flows across the Cody Shale, loses gradient, and becomes intermittent before disappearing in sand. Surface waters from Crooks Creek never reach the Sweetwater River (Stephens, 1964). This unusual characteristic of Crooks Creek is due to the geologic setting of the region, in particular the presence of the Sweetwater Plateau north of Crooks Gap. The gradient of Crooks Creek reduces from about 200 feet per mile south of Crooks Gap to less than 50 feet per mile north of the Gap. North of the Gap, the water in the creek soaks into the porous sandstone in the Sweetwater River Drainage, to the extent that there is no channel of the creek extending to the Sweetwater River (Love, 1970). The creek disappears more than a mile from the river, and the groundwater in the area of the creek disappearance has been interpreted as flowing to the east, parallel to the Sweetwater River (Borchert, 1987).

Adjacent to the Project Area, cross sections of Crooks Creek and its associated ephemeral drainages were surveyed to determine hydrological and morphological characteristics (Lidstone, 2013). The creek oscillates between a sinuous single thread meandering channel and a braided channel; where, during low flow, water moves as subsurface and surface flow. Generally, channels range from steep and incised along meander bends to more gradual along straight sections. Average sinuosity is 1.4 (unit-less ratio) through the meandering sections (meandering streams have sinuosity of 1.3 and greater).

In 2010, Energy Fuels placed three gaging sites on Crooks Creek, including locations upstream (XSCCMU), adjacent to (XSCCUS), and downstream (XSCCDS) of the Project Area. The locations of the gaging sites are shown on Map 3.2-11, and Photos 3.2-2 through 3.2-4 show Crooks Creek near each of the gaging sites (Lidstone, 2013). Energy Fuels has also installed a weir near the location of XSCCUS. Crooks Creek drains approximately 90 square miles above the gaging site XSCCDS. Recorded flows have ranged from 1.8 cfs in August 2012 to 13.5 cfs in November 2013 (see Table 1 in Appendix 3-B). The variation in the creek flows is not unexpected given the variability in precipitation and snow melt in the region (Section 3.2.1.1).

Photo 3.2-2
Crooks Creek Gaging Site XSCCMU, May 2011

Photo 3.2-3
Crooks Creek near Gaging Site XSCCUS, June 2010

Photo 3.2-4
Crooks Creek Gaging Site XSCCDS, June 2010

For comparison, discharge measurements are available between 1961 and 1981 at a USGS gaging station on the West Fork of Crooks Creek, which drains an area of about 12 square miles. The discharges ranged from 0.5 cfs on June 30, 1977 to 255 cfs on July 10, 1975 (see Table 2 in Appendix 3-B).

Comparison of the available, contemporaneous flow measurements conducted along Crooks Creek (Table 1 in Appendix 3-B) indicates the increases in the flow rates in Crooks Creek from upstream to downstream locations are generally less than 15 percent of the flow rates, and in some cases there is no change or a reduction in the flow rate. The changes in the flow along the creek can be attributed to measurement difficulties, evaporation, inflow/outflow to groundwater (from both sides of the creek), and contributions from the ephemeral tributaries to Crooks Creek.

Ephemeral Drainage Characteristics

The ephemeral drainages in the Project Area include drainages that have not been affected by historic mining and reclamation but also include drainages that have been affected along a portion of their length. At the higher elevations on Sheep Mountain, the ephemeral drainages are generally steep and well-defined. The drainages, while often dry, exhibit discontinuous headcuts within the channel profile, reflecting natural adjustments to the channel grade, most likely due to the ephemeral nature of the summer thunderstorm events and headcut migration towards the drainage divide. As channel slope decreases in the downstream direction from Sheep Mountain to the Crooks Creek floodplain, channel substrate transitions from large boulders to a sand bed and the depth of incision increases. The middle sections of the ephemeral drainage profiles are typified by deeply incised, slightly sinuous channels with sandy beds. As watershed area increases downstream and topography continues to flatten, discharge disperses and channelized flow is often no longer present. On the Project scale, the site's watershed morphology is typical of a desert bajada landform, where alluvial fans coalesce. This is pronounced on the western edge of the Project Area, between the north-south road leading to the McIntosh Pit and Crooks Creek. In most cases, flow disperses from its channelized condition to sheet flow and then is collected again in a roadside ditch before it enters Crooks

Creek (Lidstone, 2013). Photos 3.2-5 through 3.2-7 illustrate the ephemeral drainage characteristics in the upper, middle, and lower stretches of the drainages (Lidstone, 2013).

Historic mining and reclamation have affected the ephemeral drainages in the Project Area in different ways. For example, Hanks Draw was used for dewatering discharges in the 1970s and 1980s. The drainage in the vicinity of the Paydirt Pit was partially reconstructed during the WDEQ-AML reclamation of the pit several years ago, although there is still a closed depression at the pit location (SW-1 impoundment). The conditions in each of the eighteen drainage basins in the Project Area (see Map 3.2-11) are described in more detail in Appendix D-6 of the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a).

Photo 3.2-5
Ephemeral Drainage at Higher Elevation in Project Area Drainage Basin SC4, June 2010

Photo 3.2-6
Ephemeral Drainage at Lower Elevation in Project Area Drainage Basin CC8, August 2010

Photo 3.2-7
Ephemeral Drainage at Lower Elevation in Project Area Drainage Basin CC5, August 2010

Surface Water Quality

Surface water quality samples have been collected since May 2010 from Crooks Creek to the three gaging sites on the creek (see Map 3.2-11). This recent water quality data was compared with older water quality data from an upstream location on the creek, near the Jackpot Mine (see Map 3.2-10), and from the West Fork of Crooks Creek at the USGS gaging station. Samples have also been collected from the McIntosh Pit and Western Nuclear Pond. Attempts to collect streamflow samples from the ephemeral drainages were not successful due to the short duration, infrequent flow events in these tributaries. To represent the ephemeral flows, the three ephemeral surface water impoundment sites (SW-1, SW-2, and SW-3) were sampled (see Map 3.2-11). The surface water sampling history for this Project is summarized in Table 3 in Appendix 3-B.

Table 4 in Appendix 3-B includes the regulatory criteria used for evaluation of the surface water quality data. The table includes WDEQ-WQD surface water standards. It also includes WDEQ-WQD groundwater classification criteria and EPA drinking water criteria. The groundwater criteria are included because they provide insight on the parameter concentrations of concern to various water uses, e.g., livestock. Similarly, the EPA drinking water criteria, including the secondary guidelines, are included because they provide insight on what would be necessary for a public water supply system.

Crooks Creek. In general, the water quality in Crooks Creek at Energy Fuels' monitoring stations meets the WDEQ-WQD and EPA standards (Table 4 in Appendix 3-B). The exceptions are for parameters that could be expected to be elevated in this region, e.g., iron, manganese, nitrogen (ammonia), gross alpha, and uranium; however, the elevated concentrations are not consistent. They may only occur as a maximum in the results, such as during high runoff, and they are generally associated with analyses of unfiltered samples (i.e., 'total' or 'suspended' analyses). There is no readily apparent, consistent increase or decrease of parameter concentrations from the upstream to downstream sampling locations.

Analyses for physical parameters included: pH, conductivity, total dissolved solids (TDS), total suspended solids (TSS), and turbidity (Table 5 in Appendix 3-B). Data collected from water in Crooks Creek indicated slightly alkaline conditions (average pH=8.3), and a low concentration of suspended solids. Dissolved solids were measured to be fairly high, but did not exceed secondary maximum contaminant levels (SMCLs) for public water systems as defined by 40 CFR § 143.3. The electrical conductivity within Crooks Crook was measured to be average for a freshwater stream, with average freshwater streams ranging from 100 to 2,000 micromhos per centimeter (µmhos/cm) (Lidstone, 2013). Turbidity changes seasonally with discharge and sediment influx but averages 5.4 Nephelometric Turbidity Units (NTU) in Crooks Creek. Most treatment plants for drinking water in the U.S. produce water with turbidity lower than 0.3 NTU (EPA, 2013b).

Major anion and cation concentrations are also listed in Table 5 in Appendix 3-B. Water in Crooks Creek was measured to have a neutralizing alkalinity between 100 and 200 milligrams per liter (mg/l). Sulfate and fluoride concentrations were well under the SMCLs. Sodium, calcium, and silicate (solid) were all found to be less than 50 mg/l and are unlikely to be a significant contribution to adverse health effects in drinking water (EPA, 2011a).

Most dissolved metal concentrations were below the laboratory detection limits with a few exceptions. Arsenic ranged from <0.001 to 0.008 mg/l, iron ranged from <0.05 to 0.18 mg/l, and manganese ranged from <0.02 to 0.08 mg/l. Boron, selenium, and zinc were present in a few samples, but the concentrations did not exceed 0.2, 0.002, and 0.1 mg/l, respectively. None of the detected concentrations exceeded established state and federal water quality criteria (Table 4 in Appendix 3-B), with the exception of the one manganese concentration at 0.08 mg/l. The average sample concentration was below the established criteria. Concentrations of iron and manganese in unfiltered samples were higher, ranging up to 1.5 and 0.11 mg/l, respectively.

Analyses for uranium and radionuclides indicated Crooks Creek contains detectable concentrations of these parameters. Dissolved uranium was present in all the samples, and the concentrations ranged from 0.0094 to 0.0279 mg/l, compared to the regulatory criteria of 0.03 mg/l. Concentrations of suspended uranium were higher, ranging up to 0.287 mg/l. Radium-226 concentrations in filtered samples ranged from 0.5 to 2.1 picocuries per liter (pCi/l), compared to the regulatory criteria of 5 pCi/l. Suspended radium-226 concentrations were somewhat higher, ranging up to 7.1 pCi/l. The regulatory criterion is 15 pCi/l for adjusted gross alpha, i.e., gross alpha activity excluding uranium and radon activity. Unadjusted gross alpha concentrations ranged from about 9 to 49 pCi/l. Dissolved gross beta ranged from 1.6 to 10.4 pCi/l. Lead-210, polonium-201, and thorium-230, were only present in some samples, with the highest concentrations in the filtered samples being 5.3, 1.3, and 0.59 pCi/l, respectively.

For comparison, the recent sampling results were compared with historic water quality sampling data collected from Crooks Creek a few miles upstream of the Project Area, at the Jackpot Mine and at the USGS gaging station (see Map 3.2-10). The data from the baseline sampling at Crooks Creek near the Jackpot Mine included essentially the same parameters as the sampling for the Project (BLM, 1995). The data from the USGS gaging station is limited to physical parameters and major ions (USGS, 2015). The sampling results from Crooks Creek near the

Jackpot Mine indicate the water was slightly less alkaline than the water from Crooks Creek adjacent to the Project Area, with slightly less sulfate, slightly more chloride, and a slightly higher carbonate-bicarbonate ratio. In general, the dissolved trace metal concentrations, including uranium, were also slightly higher, or showed a somewhat greater range in concentrations, at the upstream location, and radium-226 concentrations were about the same. The sampling results from Crooks Creek at the USGS gaging station indicate the water quality is essentially the same as that measured adjacent to the Project Area; the only difference being more consistent detection of boron, although at very low concentrations.

The WDEQ-WQD classifies Crooks Creek as Class 2AB (WDEQ, 2013), although a segment of Crooks Creek is listed as a Category 5 impaired stream for oil and grease contamination (WDEQ, 2012a). The segment is downstream of the Project Area and is in the SWNE ¼ of Section 18 T28N R92W (WDEQ, 2012a). According to the WDEQ-WQD, ambient monitoring of Crooks Creek revealed a significant amount of oil in sediments, a violation of water quality standards. The source of oil is unknown at this time. WDEQ-WQD indicated the stream was scheduled for development of Total Maximum Daily Loads (TMDL) in 2012; however, it has not been completed (Hyatt, 2014). According to WDEQ (Hyatt, 2014), there is no recent evidence of oil and grease. WDEQ will need to collect biological, chemical, and water quality samples for 2 years before the stream segment can be delisted from Category 5. Crooks Creek is considered a low priority; therefore, it could take a few years for the assessment to be completed (Hyatt, 2014).

McIntosh Pit and Western Nuclear Pond. Analytical results for surface water samples collected from McIntosh Pit and Western Nuclear Pond are listed in Table 6 in Appendix 3-B. As discussed in Sections 2.5 and 5.3.1, Energy Fuels originally had partial responsibility for reclamation the McIntosh Pit through WDEQ-LQD Permit to Mine 381C, which is the reason water quality data has been collected from these features for several years. However, to facilitate the complete McIntosh Pit reclamation by WDEQ-AML, Energy Fuels turned over the amount of the Permit 381C reclamation bond allocated to that work to WDEQ-AML. The WDEQ-AML work addresses both the pit reclamation and improvements to Western Nuclear Pond.

In general, the water in Western Nuclear Pond is of better quality than the water in McIntosh Pit, because of the larger, less disturbed drainage to Western Nuclear Pond and lack of groundwater inflow. The water quality in both ponds will change because of the on-going WDEQ-AML reclamation work. The addition of a low permeability impoundment structure core to Western Nuclear Pond should have limited impact on the water quality once construction is completed. The water quality in McIntosh Pit should improve because the inflow of groundwater from mineralized zones in the vicinity of the pit will be curtailed by the backfilling of the pit above the water table.

Currently, the water in both McIntosh Pit and Wester Nuclear Pond is slightly alkaline (average pH of 8.3 and 8.5, respectively). TDS concentrations in McIntosh Pit are relatively high (average just over 500 mg/l), but are much lower in Western Nuclear Pond (average about 240 mg/l). Concentrations of major cations and anions, are also generally higher in McIntosh Pit, although all are below current regulatory criteria, with the exception of high sulfate concentrations from McIntosh Pit (Table 6 in Appendix 3-B).

Dissolved trace metals concentrations are almost all below laboratory detection limits, and below current regulatory criteria, with the exception of uranium. Total concentrations of iron and manganese are above regulatory criteria in Western Nuclear Pond. For uranium and radionuclides, the concentrations in McIntosh Pit are in excess of current regulatory criteria, and well in excess of the concentrations reported for Western Nuclear Pond. Although reported concentrations of suspended uranium are below the regulatory criteria of 0.3 mg/l, the average dissolved uranium concentration in McIntosh Pit was over 3 mg/l, but was less than 0.08 mg/l in

Western Nuclear Pond. Gross alpha was also over regulatory criteria in both locations, but the concentration in McIntosh Pit was over ten times the concentration in Western Nuclear Pond. Although radium concentrations in McIntosh Pit exceeded the regulatory criteria of 5 pCi/l, the concentrations in Western Nuclear Pond were less than the criteria.

Ephemeral Impoundments (SW-1, SW-2, and SW-3). The analytical results of the water quality sampling of these impoundments are summarized in Table 7 in Appendix 3-B. As noted previously, these impoundments were dry most of the time. The results of the water quality analyses from each pond showed considerable variability, which would be expected given the ephemeral nature of the flows to the impoundments. For example, in SW-1, the TDS concentrations varied from 100 to just over 7,000 mg/l. In addition, there was considerable variability in the results among the impoundments. In general, the highest concentrations were detected in SW-1 and the lowest concentrations were detected in SW-3. With respect to regulatory standards, the parameters in exceedance included aluminum, iron, manganese, uranium, gross alpha, and radium. In at least one sample from SW-1, several other parameters, such as TDS, were in exceedance, probably due to runoff relatively recent to the sampling event. Historic mining, as well as naturally occurring mineralization, are the causes for the impaired water quality at these locations, particularly SW-1. Most of the land in the drainage above SW-1 is historic disturbance; in contrast, most of the land in the drainages above SW-2 and SW-3 is undisturbed or reclaimed.

3.2.5.2 Groundwater

Groundwater occurrence and movement in the Sheep Mountain area is heavily influenced by the geologic setting, described in Section 3.2.2.2. Even though all surface water within the Project Area drains to the north-northeast into the Sweetwater River Drainage, as described in Section 3.2.5.1, the geologic setting results in groundwater flow to the west-southwest into the Great Divide Basin (see Map 3.2-10).

Crooks Gap and the Project Area are on the northeast margin of the Great Divide Basin, and the topographic low within the Basin is about 30 miles to the southwest of the Project Area. Groundwater in the aquifers within the Great Divide Basin, which is an internally drained hydrologic basin, will usually flow from the recharge areas at higher elevations around the Basin margins towards the topographic low, which is characterized by playa lakes (Welder and McGreevy, 1966; Mason and Miller, 2005). To the north of Crooks Gap, groundwater occurs in a different aquifer and flows towards the Sweetwater River (Borchert, 1977).

<u>Regional Groundwater Occurrence</u>

The aquifers within the Great Divide Basin are described first, followed by a description of the aquifer in the Sweetwater River drainage north of Crooks Gap.

Great Divide Basin. The Tertiary-aged rocks in the Great Divide Basin that make up the regional aquifer system include the Wasatch, Battle Spring, and Fort Union formations. The combined thickness of the Wasatch, Battle Spring, and Fort Union formations ranges from a few tens of feet along the basin margins to several thousand feet in the deepest portion of the Basin.

The Wasatch Formation consists of interbedded sandstones, mudstones, siltstones, and lignites. It is the shallowest formation comprising a regional aquifer in the Great Divide Basin. Groundwater characteristics of the Wasatch Formation differ within the Basin, and are dependent upon the lithology. Data collected from 104 wells sourced from the Wasatch Formation showed yields ranging from 1 to 1,300 gpm and transmissivities range from about 25 to 135 square feet per day (ft^2/day) (Mason and Miller, 2005). However, the Wasatch Formation is not generally present along the Basin margins, such as the vicinity of the Project Area (Sullivan, 1980).

The Battle Spring and Wasatch formations are often grouped together and have similar aquifer characteristics, in part because of lithologic similarities and interbedding. The Battle Spring Formation is considered a mountain-ward fluviatile facies of the Wasatch Formation and is composed of fine- to coarse-grained sandstones, minor conglomerates, siltstones, and mudstones. Saturated thickness varies throughout the Great Divide Basin, but the aquifer functions as a single heterogeneous, anisotropic aquifer when saturated except where scattered discontinuous aquitards are present (Welder and McGreevy, 1966). Collentine and others (1981) reported wells in the Battle Spring Formation with yields as high as 150 gpm but generally yields between 30 and 40 gpm. Data obtained from pump tests in 26 wells indicated transmissivity values in the Battle Spring Formation between 4 and 400 ft^2/day (Collentine et al., 1981).

The Fort Union Formation consists of fine- to coarse-grained sandstone with carbonaceous shale and coal, siltstone and claystone and often forms discontinuous lenses of sandstone and conglomerate. The sandstones within the Fort Union Formation make up 50 percent of the formation and provide plentiful water that is generally heavily mineralized (Welder and McGreevy, 1966). Compared to the Battle Spring Formation, the water-bearing layers in the Fort Union Formation are thin and fine-grained which results in lower transmissivity even though well yields are comparable. Hydraulic communication between the two formations has been demonstrated within the Great Divide Basin (Mason and Miller, 2005; Lidstone and Wright Environmental Services – Lidstone and Wright, 2013).

As noted in Section 3.2.2.2, the Lance Formation, Lewis Shale, and Mesaverde Formation underlie the Fort Union Formation in the Great Divide Basin. The formations consist of sandstones and shales, and, collectively, these formations are considered part of the Mesaverde Aquifer (Mason and Miller, 2005). Hydraulic conductivities are reported to range from 0.0003 feet per day to 2.2 feet per day (Mason and Miller, 2005). These formations are essentially absent in the Project Area.

The Cody Shale underlies the Fort Union Formation in the western side of the Project Area and is considered a regional aquitard (Whitcomb and Lowry, 1968) and part of the Baxter-Mowry confining unit described by Mason and Miller (2005). Thickness of the shale may range up to several thousand feet. Because of the thickness of the Cody Shale in the Project Area and elsewhere within the Great Divide Basin, deeper formations are not described in this EIS, but descriptions can be found in several references, including Mason and Miller (2005).

Sweetwater River Drainage. To the north of Crooks Gap, the aquifer in the Sweetwater River drainage is the Arikaree aquifer, as defined by Borchert (1977). The aquifer includes saturated rocks of the Oligocene-age White River Formation, Miocene-aged Arikaree Formation, and late Miocene-aged Ogallala Formation (Arikaree and Ogallala formations are considered part of the Split Rock Formation (Love and Christiansen, 1985)). The Arikaree aquifer is a principal groundwater source within eastern Wyoming and northern Colorado and has undergone extensive study in those areas. The Arikaree Aquifer considered in this report is limited to the Sweetwater River Basin, is largely unconfined, and contains potentially large supplies of groundwater. Saturated thickness ranges from 200 to 600 feet and data collected by Borchert (1977) shows groundwater movement toward and parallel to the Sweetwater River and hydraulic connection with the river.

<u>Groundwater Occurrence in the Vicinity of the Project Area</u>

In the vicinity of the Project Area, water-bearing zones are mostly limited to the Battle Spring Formation, but water can also be found in the Fort Union Formation. The formations are often grouped together because they are not well distinguished in the subsurface and groundwater communication often occurs between them (Welder and McGreevy, 1966; Lidstone and Wright, 2013). For the purposes of this assessment, the formations are generally considered as a single aquifer, the Project Area Aquifer. Because of the hydrologic separation between the Great Divide Basin and the Sweetwater River Drainage, in particular the presence of the Cody Shale (see Map 3.2-10 and Figures 3.2-5 and 3.2-6), the Arikaree Aquifer in the Sweetwater River Drainage is outside the area of groundwater influence of the Project. However, because Crooks Creek flows to the aquifer, information is provided on its occurrence in the vicinity of Crooks Gap.

Project Area Aquifer. Groundwater has been studied in the Project Area since the 1970s, as part of previous mining activities. To establish the current conditions prior to the proposed Project, Energy Fuels began collecting additional data in 2010, which is included in the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a) and associated annual reports. Information gathered during these studies included groundwater quality sampling and testing, potentiometric surface mapping, well installation, and pump testing to understand aquifer characteristics (see Map 3.2-12).

The Sheep Mountain Project is located within a groundwater subbasin on the northeastern margin of the Great Divide Basin (see Map 3.2-10). The subbasin is formed by a plunging synclinal fold of Cody Shale, which plunges to the south-southeast at approximately 9 degrees. The deepest portions of the subbasin are filled with over 1,000 feet of the Battle Spring Formation (Lidstone and Wright, 2013). Locally, the Battle Spring Formation may be separated into an upper and lower member (Members A and B, respectively), although the differences may be difficult to distinguish (Stephens, 1964). Where present, the Fort Union Formation may also be several hundred feet thick (Lidstone and Wright, 2013). The Mesaverde Formation may be present at depths of several hundred feet below the Project Area (see Figure 3.2-5). However, because of differences in stratigraphic interpretation, the interval identified as Mesaverde Formation beneath the Project Area may be part of the Cody Shale (Lidstone and Wright, 2013).

Beneath these formations, the Cody Shale sequence of shale and mudstone layers is over 1,000 feet thick in the Sheep Mountain Project Area. Because the Cody Shale is an aquitard, restricting vertical and lateral groundwater flow from the Project Area, the groundwater subbasin is U-shaped, opening to the south-southeast toward the Great Divide Basin (Map 3.2-13). The contact between the Project Area Aquifer and the Cody Shale, which forms the U-shaped boundary of the subbasin, is outlined on Map 3.2-13.

According to Lidstone and Wright (2013), groundwater within the Project Area generally flows from areas of high topography to areas of low topography, resulting in flow towards the west in the northern portion of the Project Area and, farther south, flow towards the southwest into the Great Divide Basin (see Map 3.2-14). Groundwater flow directions similar to topography would be expected for an unconfined aquifer such as the Project Area Aquifer. Aquifer characteristics are comparable to those measured elsewhere in the Great Divide Basin, with some influence noted from the aquifer testing method (Lidstone and Wright, 2013). The recharge to the aquifer is from infiltration of meteoric water, including snowmelt and surface water flow, in the higher elevations of Sheep Mountain.

Groundwater flow rates were calculated to range from approximately 3 feet per year (ft/yr) and 70 ft/yr. Within the Project Area, groundwater movement is affected by naturally occurring and man-made influences. With respect to natural influences, folding and shallow, normal faults are known to occur within the Project Area; however, these features are relatively small-scale and within the Battle Spring and Fort Union formations (Stephens, 1964). Folding and faulting can locally affect groundwater flow, such as elevation differences in adjacent wells; however, at the Project scale, the impacts are minimal. Regional faulting does not extend through the groundwater subbasin in which the Project is located.

Man-made influences on the groundwater flow in the Project Area Aquifer are primarily due to previous mining, including underground mining, open pit mining, and cycles of drawdown and recharge. With respect to underground mining, the historic declines, drifts, and other openings have created significantly increased horizontal and vertical permeability within portions of the Project Area Aquifer, such as the Sheep shafts. However, the extent of the influence of these man-made features is limited to the vicinity of the disturbances, i.e., it does not extend throughout the groundwater basin in which the Project is located. With respect to open pit mining, the evaporative effects at the McIntosh Pit, which intersects the water table, results in steeper hydraulic gradients closer to the pit, forming a slight depression in the water table. The WDEQ-AML reclamation work on the pit should remove the evaporative effects. With respect to cycles of drawdown and recharge, the intermittent mining history at several locations within the Project Aquifer (Section 2.2.2), has resulted in fluctuations in the potentiometric surface in the Project Area. However, the affected portions of the Project Area Aquifer generally recover relatively quickly. For example, during the most recent dewatering of the Sheep underground workings, from 1990 through late 2000, the shafts were pumped at up to 250 gpm. The measured drawdown in the Sheep 1 Shaft was on the order of 1,150 feet (Lidstone and Wright, 2013). Since the dewatering ceased in late 2000, the groundwater level in the Sheep 1 Shaft has recovered to within about 90 percent of the pre-pumping level.

Arikaree Aquifer. The southern margin of the Wind River Basin in the Sweetwater River Drainage is about 1 mile north of the Project Area. The basin deepens quickly to over 1,000 feet deep (Love, 1961 and WSEO, 1974). Near Crooks Gap, the depths to water are reported to be greatest along the edge of the aquifer, ranging from 40 to over 200 feet, and decreasing farther north into the drainage (Borchert, 1987). Hydraulic conductivities for the Arikaree aquifer are reported on the order of 2 to 35 feet per day, with horizontal and vertical conductivities being essentially the same (WSEO, 1974). The permeable, isotropic characteristics of the aquifer would contribute to the loss of Crooks Creek.

<u>Groundwater Quality</u>

The regional water quality within the Great Divide Basin is described first, followed by a description of the water quality in the Sweetwater River Drainage north of Crooks Gap. The groundwater quality in the Project Area is then described.

Regional Groundwater Quality. Within the Great Divide Basin, regardless of the aquifer, the groundwater at shallow depths along the outer portions of the Basin may be suitable for human and livestock use. However, the quality deteriorates toward the center of the Basin and at greater depths where dissolved constituents, such as salts, TDS, and radionunclides concentrate (Mason and Miller, 2005). Naturally occurring constituents, such as trona, nahcolite, shortite, dawsonite, and halite, within subsurface strata; dissolve into the groundwater and degrade water quality in the Basin. Areas of uranium mineralization within the Basin also contribute to poorer water quality in the vicinity of the mineralization. In general, the Tertiary aquifers within the Great Divide Basin are only marginally suitable or unsuitable for domestic and irrigation use, and some shallow aquifers can be suitable for livestock use (Mason and Miller, 2005).

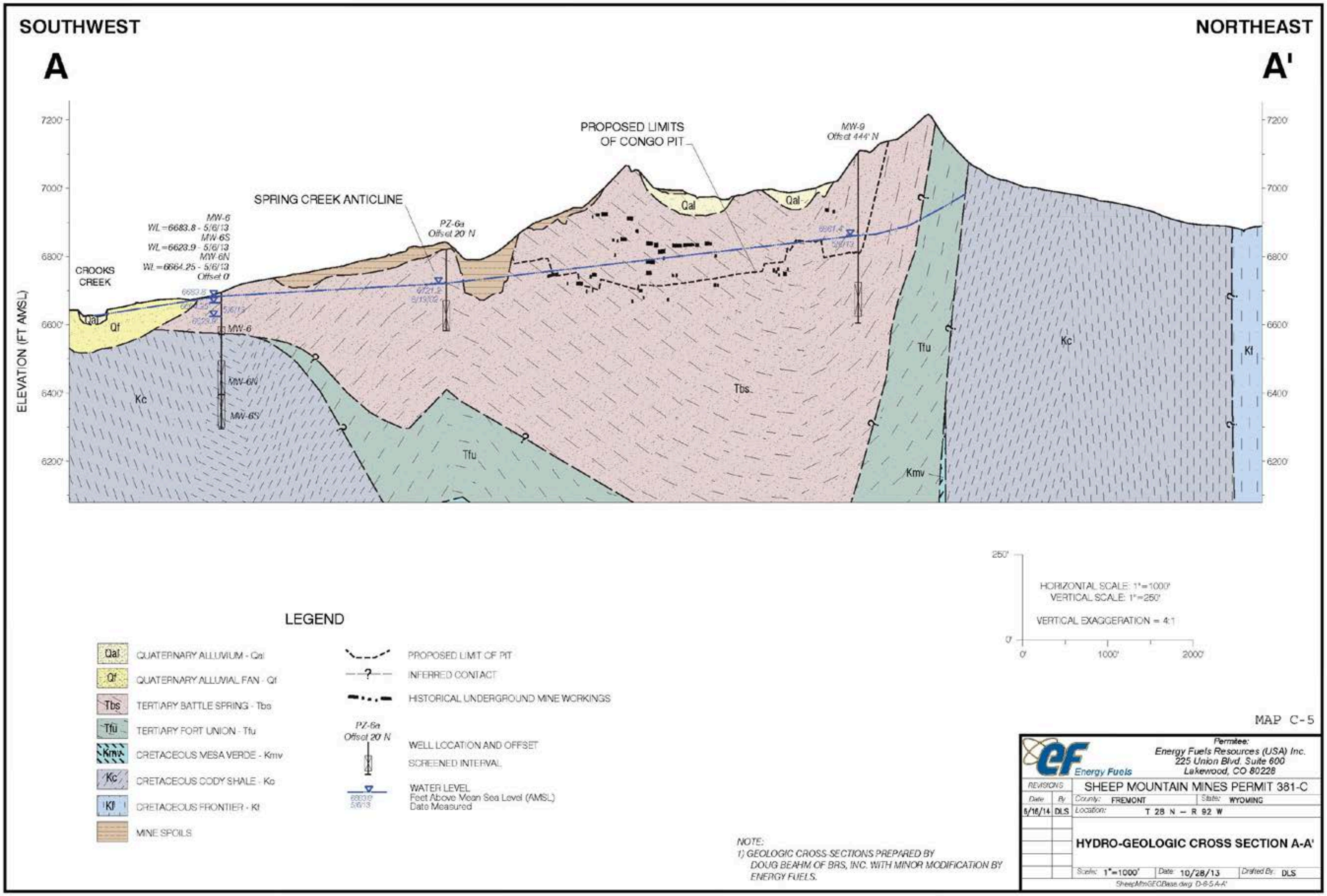


Figure 3.2-5
Hydrogeologic Cross Section A-A'

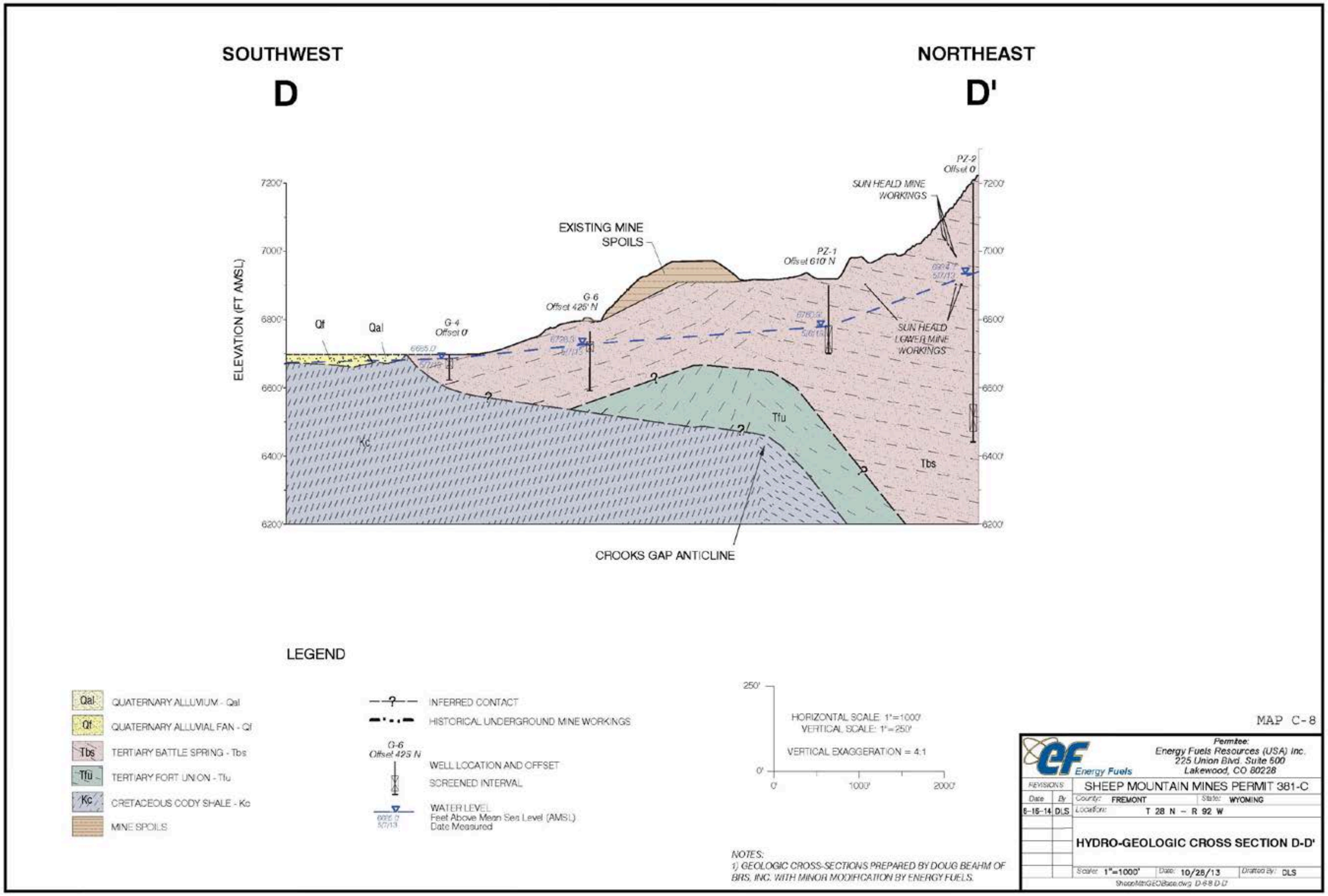
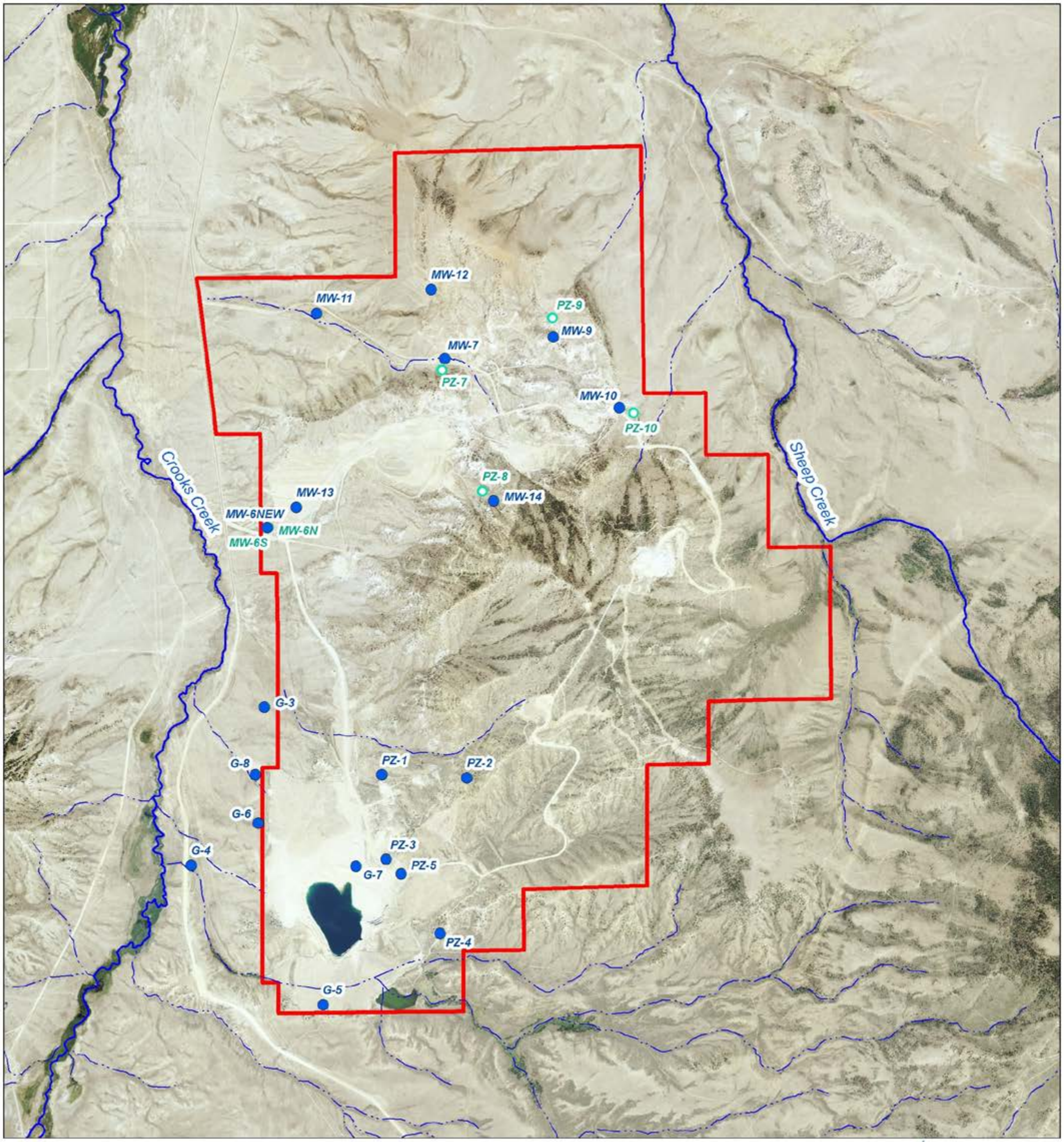


Figure 3.2-6
Hydrogeologic Cross Section D-D'



Map 3.2-12
Groundwater Monitoring Locations

Sheep Mountain Project Area

Groundwater Monitor Wells

Current

Historic

0 4,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

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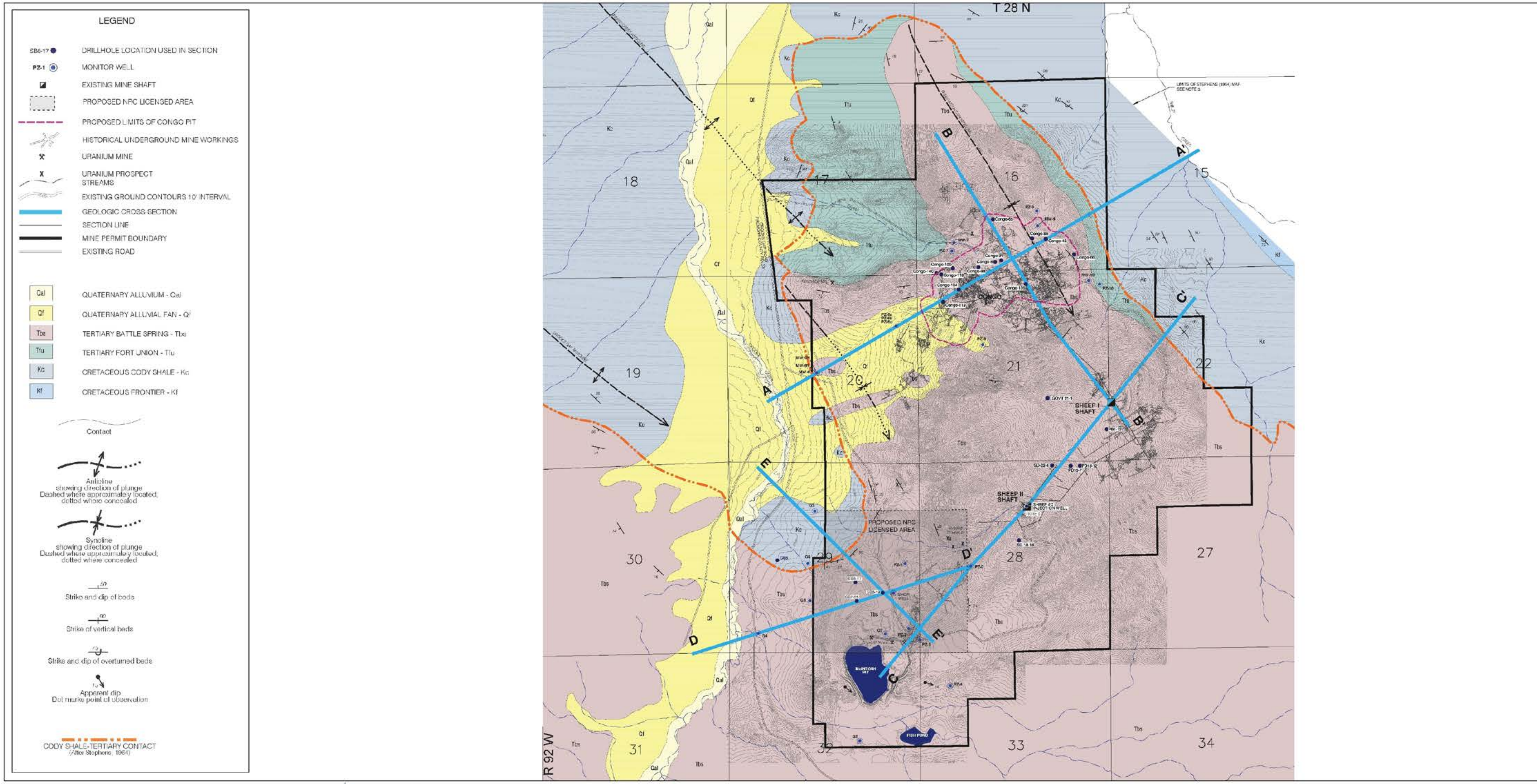

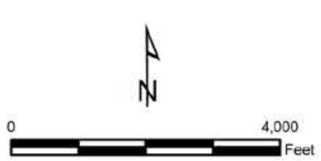

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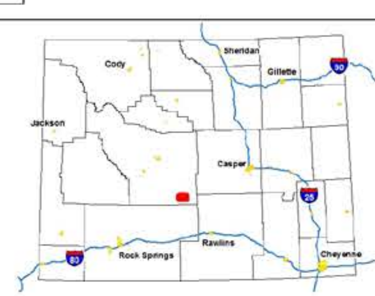

Map 3.2-13
Hydrogeologic Setting of the Project Area

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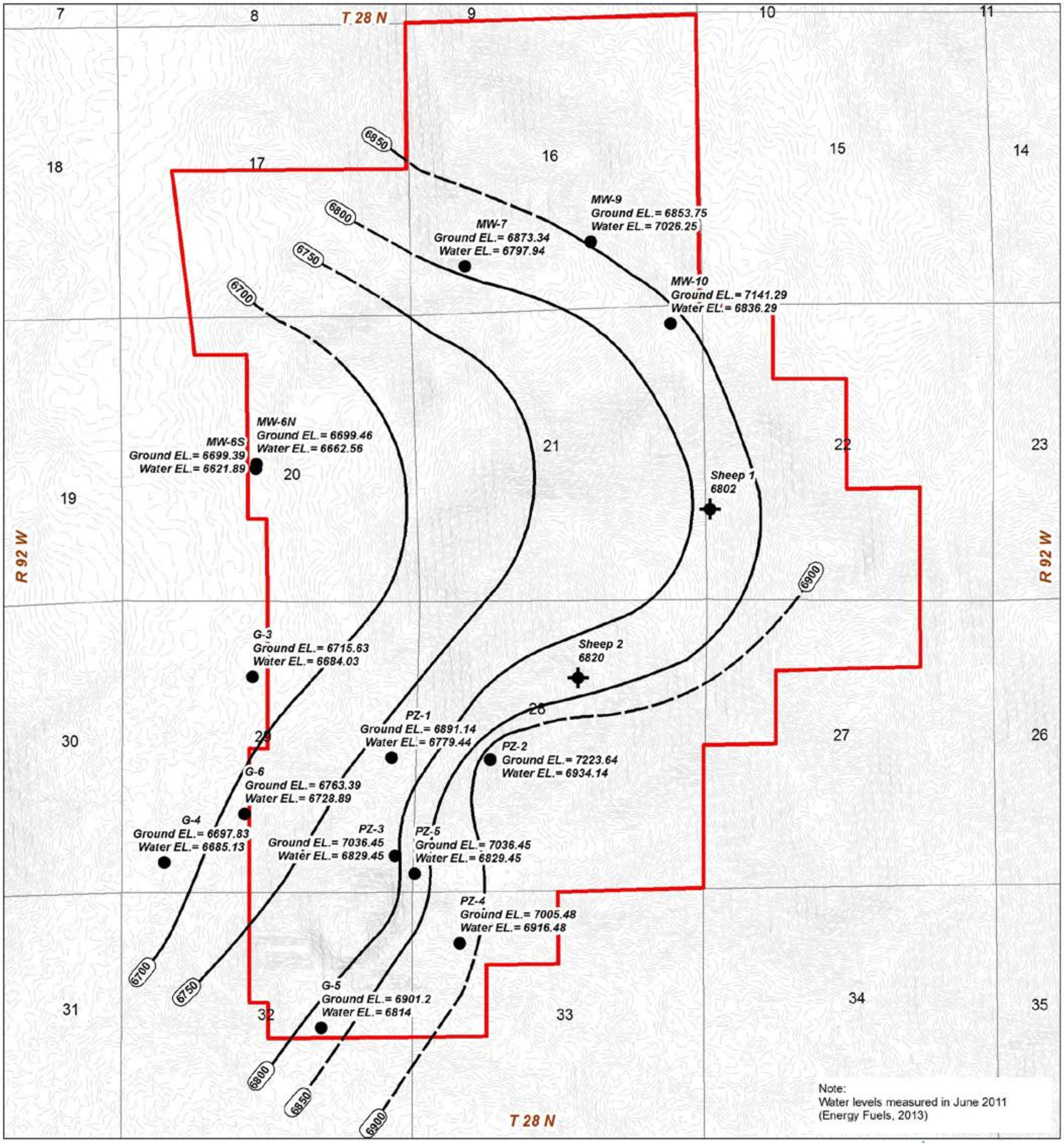


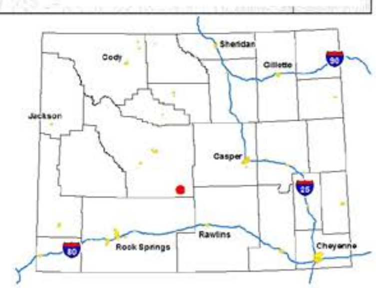
Map 3.2-14
Potentiometric Surface Map

N

0 4,000
Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

Sheep Mountain Project Area
Ground Water Contours
50ft Interval
Inferred
Monitoring Well
Mine Shaft / Water Elevation



In the Wasatch Formation, at shallow depths, concentrations of TDS in samples from shallow depths were generally reported to be less than 4,000 mg/l. The dominant cations and anions were mixed, including sodium-bicarbonate and sodium-sulfate water types. Higher TDS concentrations, along with high concentrations of sulfate and elevated sodium adsorption ratios, restrict the uses for which the water is suitable. In samples collected at depths below 500 feet, TDS concentrations were reported to increase substantially to several thousand mg/l, and the water type was generally sodium-chloride (Mason and Miller, 2005).

In the Battle Spring Formation, Collentine et al., (1981) reported TDS concentrations ranging from 150 to 7,200 mg/l in groundwater occurring less than about 1,500 feet below ground surface. The principal water types were reported to be calcium-bicarbonate, sodium-bicarbonate, sodium-sulfate, or some mixture of the three (Mason and Miller, 2005). Groundwater with relatively low concentrations of TDS was reported to contain more sodium-bicarbonate compared to groundwater with higher TDS concentrations (up to 1,000 mg/l) which contained more calcium-sulfate. The difference was considered to be the result of dissolution of gypsum/anhydrite, increasing salinity and enriching calcium and sulfate within the formation (Collentine et al., 1981). Mason and Miller (2005) reported that groundwater within the Battle Spring Aquifer tends to contain high concentrations of radionuclides including: radon-222, uranium, radium-226, radium-228, and gross alpha and beta radiation. Concentrations of radon in several samples were found to exceed the EPA proposed maximum contaminant level (MCL) of 4,000 pCi/l for radon. Based on EPA standards (EPA, 2011a), the water within the Battle Spring Aquifer is generally suitable for irrigation and livestock, and can be suitable for domestic use where radionuclides are not concentrated.

In the Fort Union Formation, groundwater quality is reported as highly variable, but Mason and Miller (2005) found the overall quality in water from shallow wells in the formation to be either suitable for livestock or marginally suitable for domestic use, based on comparison with EPA criteria (2011). Elevated sulfate concentrations and salinity made water from most samples unsuitable for irrigation use. Concentrations of TDS, sulfate, and manganese in many of the samples were found to exceed regulatory criteria such as EPA's SMCLs. Water contained dominant cations of calcium and sodium and dominant anions of bicarbonate and sulfate. Water produced from deeper wells in the Fort Union Formation generally had much poorer quality than water from shallower wells or springs. Production from an average depth of 4,100 feet yielded water with TDS concentrations ranging from 1,170 to 153,000 mg/l (Mason and Miller, 2005).

Similar to the water quality distribution in the shallower formations, groundwater quality in the formations making up the Mesaverde Aquifer is generally of better quality on the margins of the Great Divide Basin, deteriorating with depth toward the Basin center. Collentine et al. (1981) reports TDS concentrations ranging from 500 to over 50,000 mg/l depending on locations within the Basin. Also, similar to changes in water chemistry in the shallower formations in the Basin, the water type changes from sodium-bicarbonate, associated with TDS concentrations less than 1,000 mg/l, to calcium-sulfate, associated with TDS concentrations from 1,000 to 3,000 mg/l. At higher TDS concentrations, sodium-chloride-bicarbonate becomes characteristic, with essentially no sulfate.

Throughout the Sweetwater River Drainage, the groundwater quality in the Arikaree Aquifer is generally considered to be very good with respect to parameters such as TDS and major cations and ions. Even so, the proximity to uranium sources such as the Granite Mountains and mineralization on the north side of Sheep Mountain has resulted in distribution of uranium in the drainage. Uranium concentrations in twenty groundwater samples from the Split Rock Formation, which is part of the aquifer, were reported to average 0.009 mg/l, with generally higher concentrations in four samples collected near Crooks Gap. The reported uranium concentrations in these samples were 0.006, 0.039, 0.044, and 0.050 mg/l (Love, 1961), three of which were in excess of the current EPA MCL of 0.03 mg/l.

Groundwater Quality in the Project Area. Groundwater quality data has been collected from wells in the Project Area since the late 1970s, as part of historic mining activities (Lidstone and Wright, 2013). To determine the current groundwater quality conditions prior to the proposed Project, groundwater samples have been collected since 2010 from 22 locations, including 21 wells and the Sheep I Shaft (see Map 3.2-13). The sampling results are summarized in Table 8 in Appendix 3-B, and the complete results are available in Appendix D-6 of WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a).

The pH values indicate the groundwater in the Project Area is slightly alkaline, ranging from 7.1 to 8.8, and most of the concentrations of TDS range from about 150 to 790 mg/l in wells in the Project Area Aquifer (Battle Spring and Fort Union formations). The highest concentrations, from 850 to 2,300 mg/l, are in wells completed in the Cody Shale. Concentrations of major cations and anions are generally low within the Project Area Aquifer and do not exceed existing regulatory criteria, with the exception of the chloride concentration in one of the Cody Shale wells. Groundwater quality varies across the site, depending in part on the local lithology. For example, higher sulfate concentrations generally occurred in the same wells with higher uranium concentrations, except in the Cody Shale wells (see Table 8 in Appendix 3-B). Where the Battle Spring Formation is considered predominant, groundwater chemistry is generally characterized as calcium-sodium bicarbonate-sulfate type water. Where the Fort Union Formation is predominant, groundwater contains less calcium and is dominated by sodium-bicarbonate-sulfate type waters. The one anion which, if detected, exceeded any regulatory criteria was ammonia. Although few of the samples exceeded the WDEQ-WQD criteria of 0.5 mg/l for Class I (Domestic), several samples exceeded the groundwater Special (A) Class (Fish and Aquatic) criteria of 0.02 mg/l.

Generally, metal concentrations in Project Area groundwater are reported as non-detect or are detected at concentrations below regulatory criteria. The exceptions were for dissolved aluminum and manganese and for total iron and manganese, which would not be unexpected in this region. Concentrations of these metals exceeded regulatory criteria in several wells. Arsenic, copper, and selenium were generally not detected, although each were detected in two or three different wells and some of the detections exceeded regulatory criteria.

As would be expected in an area of uranium mineralization, concentrations of uranium and radium and measured gross alpha activities are relatively high, compared to WDEQ-WQD and EPA regulatory criteria, in several wells in the Project Area. The highest concentrations appear to be associated with areas of historic mining activity, which would not be unexpected given the likelihood of residual mineralization around these areas (i.e., not all the mineralized material was removed by prior mining). In general, groundwater quality within the Project Area does not meet WDEQ-WQD Class III standards because of elevated radium and gross alpha concentrations (Lidstone and Wright, 2013).

The relatively lower pH values and higher metal concentrations present in some wells are not considered indicative of acid generation and mineral oxidation. No correlations of the parameters generally associated with acid generation and mineral oxidation (e.g., pH, sulfate, iron, manganese, and aluminum) is apparent, and the concentrations of most metals are below laboratory detection limits. With respect to geographic distribution, the pH values in the groundwater samples from the southern portion of the site are generally, but not consistently, lower than those from the northern portion of the property. The pH values in the northern portion of the site, north of Sheep II, range from 7.7 to 8.7, and in the southern portion of the site range from 7.0 to 8.5 with one lower value of 6.5. However, there does not appear to be any other consistent geographic distribution of other parameters. There also do not appear to be any consistent trends in the pH concentrations. The variations in the parameter concentrations are considered indicative of the complex mineralization in the subsurface materials.

The water quality data from the wells completed in the Project Area, which is on the northern edge of the Great Divide Basin, were compared to the limited data available from locations within the basin and within a few miles of the Project Area. The comparison confirms that the data from the Project Area is consistent with the regional water quality characteristics of the shallow aquifers within the basin. For example, the results from the groundwater quality sampling to establish baseline conditions at the Jackpot Mine (see Map 3.2-10) are relatively similar to those collected in the Project Area, exclusive of the areas of prior disturbance. The Jackpot Mine is also located along the margin of the Great Divide Basin, with wells completed in the Battle Spring Formation (BLM, 1995). In contrast, Welder and McGreevy (1966) present the data for a well about 1 mile south of the Project Area, which is reported to be completed in the Wasatch and Battle Spring formations. The reported concentration of TDS, 1,850 mg/l, is elevated compared to the TDS in the Project Area Aquifer, which would be expected moving from the basin margin into the basin. Concentrations of the major cations and anions reported for this well are also consistently higher than those in the Project Area. Uranium concentrations in samples from a variety of sources around Crooks Gap show a similar range as in the Project Area Aquifer. For example, Stephens (1964), in work continued from Denson et al. (1955), reports uranium concentrations from spring and well samples collected in T28N R92W ranging from 0.001 to 0.255 mg/l.

3.2.5.3 Water Rights and Water Use

Surface Water

Information on the surface water rights within the Project Area and within 3 miles of that area was obtained from Wyoming State Engineers Office (WSEO) e-permit database (WSEO, 2013). The surface water rights within the Project Area and within 0.5 miles of that area are listed in Table 1 in Appendix 3-C, and the surface water rights between 0.5 and 3 miles from the Project Area are listed in Table 2 in Appendix 3-C. The locations of the surface water rights listed in the tables are shown on Map 3.2-15.

Along Sheep Creek, four of the seven listed water rights within 0.5 miles of the Project Area are associated with three pipelines that are used by The Union Oil Company of California for drilling operations. The other three listed water rights within 0.5 miles of the Project Area are associated with irrigation ditches. Farther downstream, within 3 miles of the Project Area, there are eight listed water rights associated with irrigation ditches. The listed uses for the surface water rights, which date from the early 1900s, include irrigation (primarily for hay or pasture grass), stock watering, and domestic uses, along with oil and gas operations. Historically, irrigated acreage was limited to a less than 200 acres (WSEO, 1910), but by 1970, no irrigated acreage was reported for Sheep Creek (Hunter et al., 1971) The current surface water uses along Sheep Creek are generally limited to occasional industrial use at the Sheep Creek Oil Field and stock watering.

Along Crooks Creek, six of the fourteen listed water rights within the Project Area were acquired by Energy Fuels, and the water will be put to the uses specified in the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a). Similar to Sheep Creek, two of the listed water rights within 0.5 mile of the Project Area are used for oil and gas operations. One of the listed water rights is for temporary use by the Fremont County Transportation Department. The other five listed water rights within 0.5 mile of the Project Area and the water rights farther downstream within 3 miles of the Project Area are associated with irrigation ditches or small reservoirs. As in Sheep Creek, the water rights generally date to the early 1900s, and the uses have changed over time. In

1910, no irrigated acres were reported along Crooks Creek (WSEO, 1910), and in 1971, about 500 acres along the entire length of Crooks Creek and its tributaries were reported as irrigated (Hunter et al., 1971). Currently, less than 100 acres are apparently irrigated, including subirrigation for pasture next to the creek and ditches, and most of those acres are at least 3.5 miles downstream of the Project Area.

Non-designated use of waters within the Project Area and in Crooks Creek, Sheep Creek, ponds, and wetlands near the Project Area consist primarily of use by cattle where access to these features can be obtained. Cattle often frequent the Project Area and drink from surface waters within the Western Nuclear Pond, and could reach McIntosh Pit but have never been observed drinking from the pit. Some areas of Crooks Creek have been fenced to keep cattle from accessing the wetlands, but in general cattle and wildlife can access Crooks Creek when it is not frozen or during the summer months when the creek has enough water for drinking.

<u>Groundwater</u>

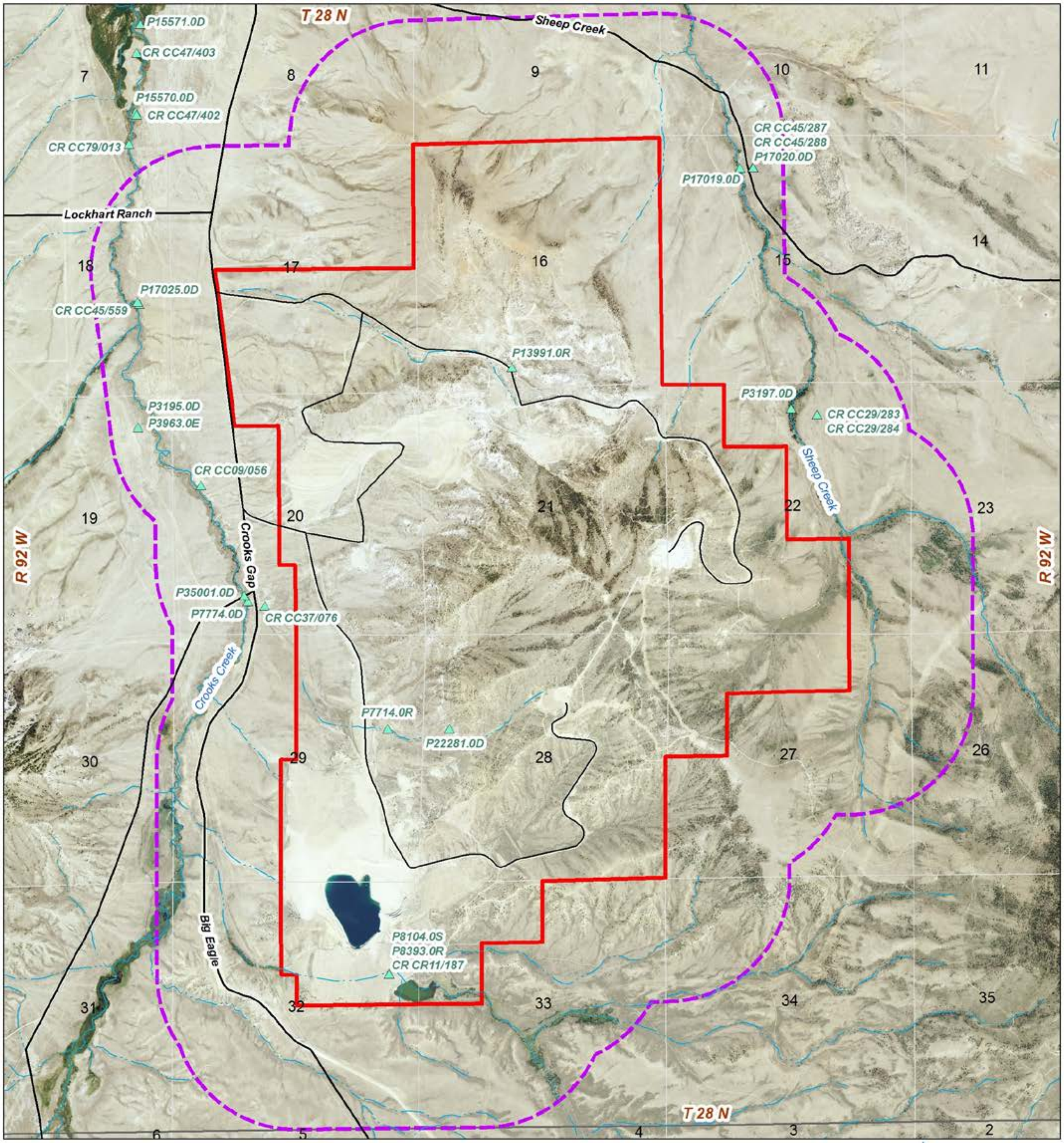
Information on the groundwater rights within the Project Area and within 3 miles of that area was obtained from the WSEO e-permit database (WSEO, 2013). This information is listed in Table 3 in Appendix 3-C, and the locations are shown on Map 3.2-16.

According to the WSEO database (WSEO, 2013), there are 30 groundwater permits within the Project Area. All the water rights within the Project Area were acquired by Energy Fuels, and the water will be put to the uses specified in the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a).

Outside the Project Area, no permitted water wells within 2 miles of the Project Area are being put to beneficial use (WDEQ, 2015a). The WSEO database lists six water rights associated with the Big Eagle Mine, which is about 2 miles to the east-southeast of the Project Area and is in reclamation. The database also lists six water rights associated with the Jackpot Mine (Green Mountain Mining Venture), which is about 3 miles east of the Project Area and is also in reclamation. To the north of Crooks Gap, the database lists five water rights. The closest permanent residence is the Claytor Ranch, which is about 3.5 miles north of the Project Area. The groundwater north of the Gap is generally separated from the Project Area by the Cody Shale.

Under the EPA's Source Water Assessment Program (SWAP), groundwater in the Project Area is mapped as Zone 3. Zone 3 includes watersheds upgradient of an aquifer which could fall within the capture zone of a public water supply well. According to SWAP data, the nearest public source of drinking water is 3.5 miles to the southeast of the Project Area. This location consists of one water well, several potential creek-water capture zones, and one reservoir (A&M Reservoir) used for public consumption along the Continental Divide Trail (BLM, 2010). The reservoir is on an unnamed drainage which flows to the west into the Great Divide Basin and is artificially supplied by a Merit Energy Company well and a BLM well (WGFD, 2004). If well water were not pumped to the reservoir, it would be dry. The location is well outside the area of influence of the Project (see Map 3.2-10).

The next closest public source of drinking water is located in Jeffrey City approximately 5.8 miles north of the Project Area (Map 3.2-10), and is part of the Jeffrey City Water and Sewer District (Public Water Source Permit: PWS #56000106). The attenuation zone for the Jeffrey City municipal well (SWAP Zone 2 area) is 5.75 miles from the Project Area. The Jeffrey City well is completed in the Arikaree Aquifer (609 Consulting, LLC, 2013) in the Sweetwater River Drainage. This aquifer is on the opposite side of Crooks Gap from the Project Area and is also generally separated from the Project Area by the effective aquitard of the Cody Shale.

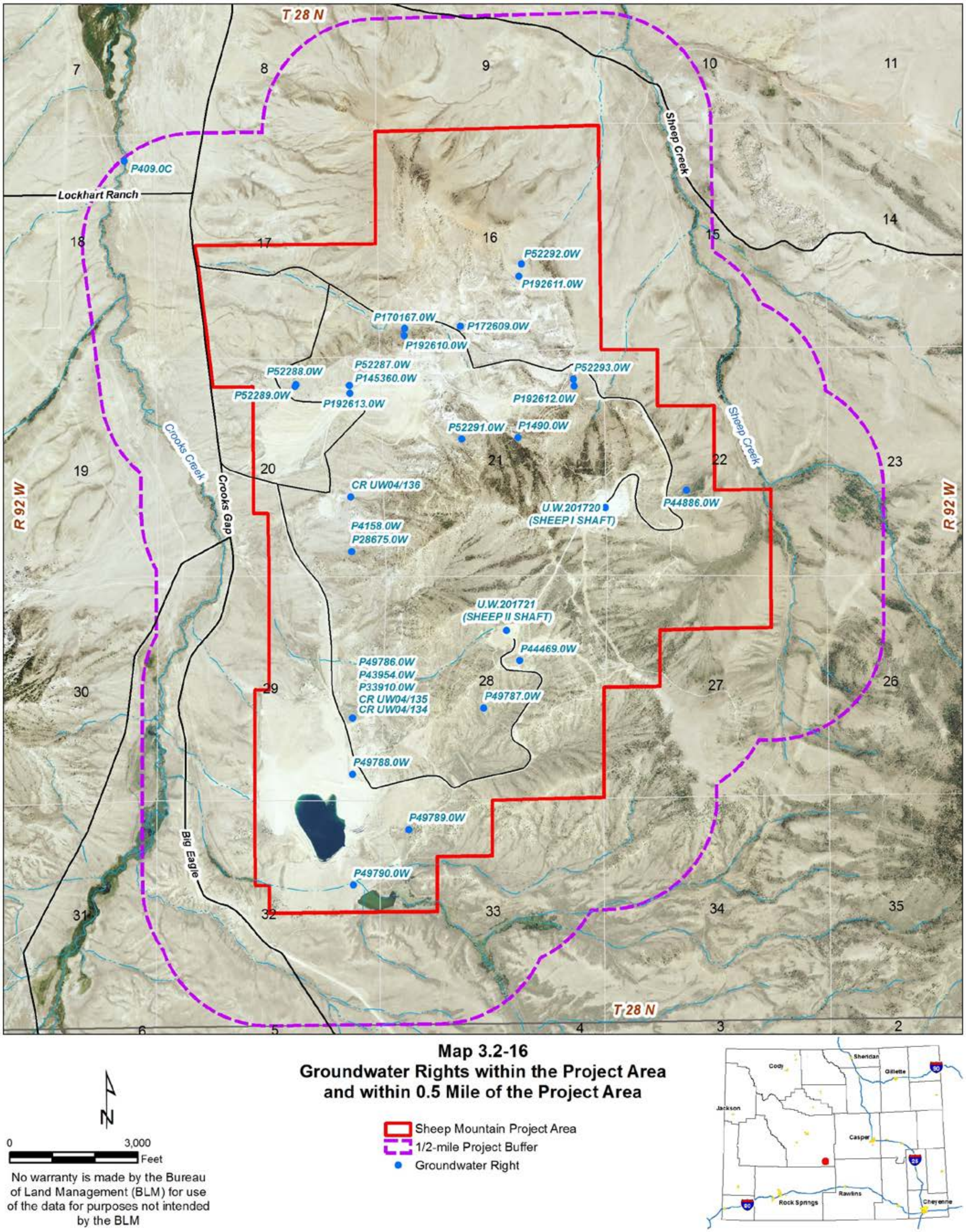


Map 3.2-15
Surface Water Rights within the Project Area and within 0.5 Mile Downstream of the Project Area

Sheep Mountain Project Area
1/2-mile Project Buffer
Surface Water Right

N
0 3,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM



Map 3.2-16
Groundwater Rights within the Project Area
and within 0.5 Mile of the Project Area

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3.3 BIOLOGICAL RESOURCES

3.3.1 Invasive, Non-Native Species

The State of Wyoming lists 25 plants as designated noxious weeds that the Wyoming Weed and Pest Council and Wyoming Board of Agriculture have found to be detrimental, destructive, injurious, or poisonous and should be controlled within the State of Wyoming. Fremont County Weed and Pest is responsible for implementing and pursuing an effective program for the control of designated weeds (Wyoming Weed and Pest Control, 2011). Fremont County has established three weed management areas in which the county enters into cooperative agreements with landowners and public land management agencies to facilitate, promote, and coordinate wide scale integrated weed and pest management. Fremont County Weed and Pest Control District (WPCD) also identifies 11 “weeds of concern” that are non-native species and can be invasive under the right conditions (Fremont County, 2011), and should be controlled if documented.

The BLM LFO contracts annually with the Fremont WPCD for control (i.e., inventory, spraying, releasing insect vectors, and monitoring) of weeds on BLM-administered lands. This is done as a cooperative effort with private landowners who are engaged in weed control programs on their own lands. Without these precautionary actions, untreated federal lands could serve as a seed source of weeds for invading private lands that have weed control programs.

The Project Area lies within the Popo Agie Weed Management Area (PAWMA), the boundaries of which correspond to those of the Popo Agie Conservation District, which in this area is the county line. The PAWMA is a group of local, state, and federal agencies that work through a Memorandum of Understanding (MOU) with the Fremont County WPCD to assist the landowners in the area with controlling noxious weeds.

No noxious weeds were sighted within the study area during the 1980 reconnaissance surveys. During pedestrian reconnaissance surveys in 2010, one state designated weed, Canada thistle (*Cirsium arvense*), and one county designated weed, bull thistle (*Cirsium vulgare*) were noted within the Project Area. Bull thistle was documented on the reclaimed land south of the Congo Pit within the affected area and Canada thistle was located on a historical mine exploration road west of Sheep II Shaft, outside of the affected area, but within the Project Area (BKS, 2011b). Russian olive (*Elaeagnus angustifolia*), spotted knapweed (*Centaurea maculosa*), musk thistle (*Carduus nutans*), and black henbane (*Hyoscyamus niger*) have been documented in or within a 1-mile radius of the Project Area. Table 3.3-1 identifies the 25 Wyoming designated weeds, as well as the 11 weeds of concern identified by Fremont County.

Table 3.3-1
State of Wyoming Designated Noxious Weeds and Fremont County Weeds of Concern

Common Name/ Scientific Name	Characteristics	Distribution/Location in Relation to the Proposed Action
State of Wyoming Designated Weeds		
Canada Thistle *Cirsium arvense*	Initially establishes itself in disturbed soils; reproduces by seed and creeping rootstock.	Documented within the Project Area; along Crooks Gap/Wamsutter Road, Crooks Creek within 0.5 mile of Project Area.
Common Burdock *Arctium minus*	Commonly found growing along roadsides, ditch banks, in pastures and waste areas; reproduces by seed.	Located >20 miles from Project Area.
Common St. Johnswort *Hypericum perforatum*	Frequently found on sandy or gravelly soils; reproduce by seed or short runners.	Not known in Fremont County.
Common Tansy *Tanacetum vulgare*	Found along roadsides, waste areas, stream banks, and in pastures; reproduces from seed and rootstalks.	Located >20 miles from Project Area.
Dalmation Toadflax *Linaria dalmatica*	Found along roadsides and on rangeland; reproduces by seed and underground rootstalks.	Located >20 miles from Project Area.
Diffuse Knapweed *Centaurea diffusa*	Occurs along roadsides, waste areas, and dry rangelands and dominates disturbed areas; reproduces by seed.	Known populations located within the Cooper Creek and Willow Creek drainages; slopes of Green Mountain.
Dyers Woad *Isatis tinctoria*	Occurs along roadsides and disturbed sites and spreads from there to rangeland and cropland by seeds.	Not known in Fremont County.
Field Bindweed *Convolvulus arvensis*	Occurs in cultivated fields and waste places; reproduces by seeds and root stalks.	Known populations located outside of the former Green Mountain Common Allotment (GMCA), Sweetwater Station.
Hoary Cress (Whitetop) *Cardaria draba (C. pubescens)*	Prevalent in areas with alkaline or disturbed soils; reproduces from seed and rood segments.	Known populations located within 5 miles of Project Area, along the Sweetwater River and US Highway 287.
Houndstongue *Cynoglossum officinale*	Found in pastures, along roadsides, and in disturbed habitats; reproduces by seed.	Located >20 miles from Project Area.
Leafy Spurge *Euphorbia esula*	Grows in nearly all soil types and habitats; reproduces by seed and rootstalks.	Known populations located within 15 miles of Project Area, along western portions of the former GMCA.
Musk Thistle *Carduus nutans*	Invades pastures, range and forest lands, roadsides, waste areas, ditch banks, stream banks, and grain fields; reproduces rapidly by seed.	Known populations located along Crooks Creek outside of the Project Area.
Ox-eye Daisy *Chrysanthemum leucanthemum*	Found in meadows, roadsides, and waste places; reproduces by seed.	One population observed in Project Area.
Perennial Pepperweed (giant whitetop) *Lepidium latifolium*	Occurs in riparian areas, waste areas, ditches, roadsides, croplands, range and meadows, and disturbed areas; reproduces by seed and deep-seated rootstalks.	Known populations located along the Sweetwater River outside of the former GMCA.
Perennial Sowthistle *Sonchus arvensis*	Common in gardens, cultivated crops, ditch banks, and fertile waste areas; reproduces by seed and creeping roots.	Located >20 miles from Project Area.
Plumeless Thistle *Carduus acanthoides*	Occurs in pastures, stream valleys, fields, and roadsides; reproduces by seed.	Not known in Fremont County.
Purple Loosestrife *Lythrum salicaria*	Infest moist, marshy or wet areas such as canals, ditches, or lake edges; reproduce by seed.	Not known in Fremont County.
Quackgrass *Agropyron repens*	Occurs in croplands, pastures, rangeland, and roadsides; reproduces by seed or spreading by rhizomes.	Known populations located along the Sweetwater River outside of the NW boundary of the former GMCA.
Russian Knapweed *Centaurea repens*	Occurs in a variety of habitats and forms colonies in cultivated fields, orchards, pastures, and roadsides; reproduces by seeds and creeping rootstocks.	Known populations in western GMCA along Bison Basin Road, at Picket and Daley Lake, along Sweetwater River outside the former GMCA.

Common Name/ Scientific Name	Characteristics	Distribution/Location in Relation to the Proposed Action
Russian Olive *Elaeagnus angustifolia*	Invade low-lying pastures, meadows, or waterways; reproduces by seed.	Common in Fremont County; treated with the Project Area on a previous mine disturbance.
Saltcedar (Tamarisk) *Tamarix* spp.	Invades wetlands, moist ranges, lake sides, stream banks, sandbars, and other saline environments; reproduces by seed.	Known populations located within 15 miles of Project Area, near Sweetwater Station and Lost Creek Reservoir in the Great Divide Basin.
Scotch Thistle *Onopordum acanthium*	Found along waste areas and roadsides; very aggressive; reproduces by seed.	Known populations located within 15 miles of the Project Area.
Skeleton Bursage *Franseria discolor*	Aggressive growth habits; spread mainly by creeping roots.	Not known in Fremont County.
Spotted Knapweed *Centaurea maculosa*	Establish in disturbed soils; very aggressive; reproduces by seed.	Known populations located on Crooks Creek adjacent to the Project Area.
Yellow Toadflax *Linaria vulgaris*	Occurs in rangelands, along roadsides, waste places, and cultivated fields; reproduces by seed and creeping roots.	Located >20 miles from Project Area.
Fremont County Weeds of Concern		
Absinth Wormword *Artemisia absinthium*	Flowers from late July through August	Not known in Fremont County.
Black Henbane *Hyoscyamus niger*	Common in pastures, along fencerows, along roadsides, and waste areas.	Known populations located within 5 miles of Project Area along the Crooks Gap/Wamsutter Road.
Bull Thistle *Cirsium vulgare*	Occurs in pastures, roadsides, and disturbed sites; reproduces by seed.	Documented within the Project Area; other known populations located > 20 miles of Project Area.
Common Mullein *Scrophulariaceae*	Common along river bottoms, pastures, meadows, fence rows, and waste areas, especially on gravelly soils; reproduces by seed.	Known populations located within 10 miles of Project Area.
Japanese Knotweed *Polygonum cuspidatum*	Occurs in roadsides, waste areas, ditch banks, and pastures; reproduces by creeping rhizomes.	Located >20 miles from Project Area.
Marsh Sowthistle *Sonchus arvensis*	Occurs along roadsides, fields, and disturbed areas; spread by seed and extensive roots.	Located >20 miles from Project Area.
Puncturevine *Tribulus terrestris*	Grows in pastures, cultivated fields, waste areas, and along highways and roads; reproduces by seed.	Located >20 miles from Project Area.
Russian Thistle *Salsola iberica*	Found in disturbed wastelands, over-grazed rangeland, and irrigated and dryland ag; reproduces by seed.	Not known in Fremont County.
Sulphur Cinquefoil *Potentilla recta*	Found in disturbed areas such as roadsides and pastures; colonies are also often seen in undisturbed sites; flowers from May to July.	Located >20 miles from Project Area.
Swainsonpea *Sphaerophysa salsula*	Commonly found along roadsides and fences; reproduces by seed and lateral roots.	Known populations located within 5 miles of Project Area.
Wild Licorice *Glycyrrhiza lepidota*	Commonly found in moist, sandy soils of meadows, pastures, prairies, ditches and river banks, and waste areas; reproduces from deep roots and seed.	Known populations located within 10 miles of Project Area.
Under Review for Fremont County		
Cheatgrass *Bromus tectorum*	Cheatgrass is an invasive annual grass. Fire frequency is increased with cheatgrass invasion; the establishment of cheatgrass causes substantial competition for resources used by native shrubsteppe species.	Present in the Project Area.
Baby's Breath *Glypsophila paniculata*	An ornamental species that has escaped cultivation; can form dense stands competing with forage species and is difficult to control.	Populations within 10 miles of Project Area.
Sources: Fremont County, 2011; Fremont County, 2004b; BKS, 2014b; Cohen, 2015.		

3.3.2 Vegetation

Elevations in the Project Area range from about 6,600 in the northwest corner to 7,835 feet at the top of Sheep Mountain. Vegetation types within the Project Area appear to be directly related to the geographic and topographic locations of soils, soil depths, slope, aspect, and elevation.

The Project would be located within an area defined by the NRCS as Major Land Resource Area (MLRA) 34A – Cool Central Desertic Basins and Plateaus (USDA, 2006). MLRA 34A contains a semi-desert grass-shrub zone, the largest zone within the MLRA, is characterized by a vast sagebrush steppe within central and southern Wyoming and extending into northwestern Colorado. This zone occurs in the areas receiving 8 to 16 inches of annual precipitation. The representative vegetation includes Wyoming big sagebrush (*Artemisia tridentata wyomingensis*), antelope bitterbrush (*Purshia tridentata*), western wheatgrass (*Pascopyrum smithii*), bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread (*Hesperostipa comata*), prairie junegrass (*Koeleria macrantha*), and Indian ricegrass (*Achnatherum hymenoides*). Utah juniper (*Juniperus osteosperma*) may occur in small areas. Cottonwood (*Populus* spp.) and willows (*Salix* spp.) grow in riparian zones along the major perennial streams and rivers (USDA, 2006).

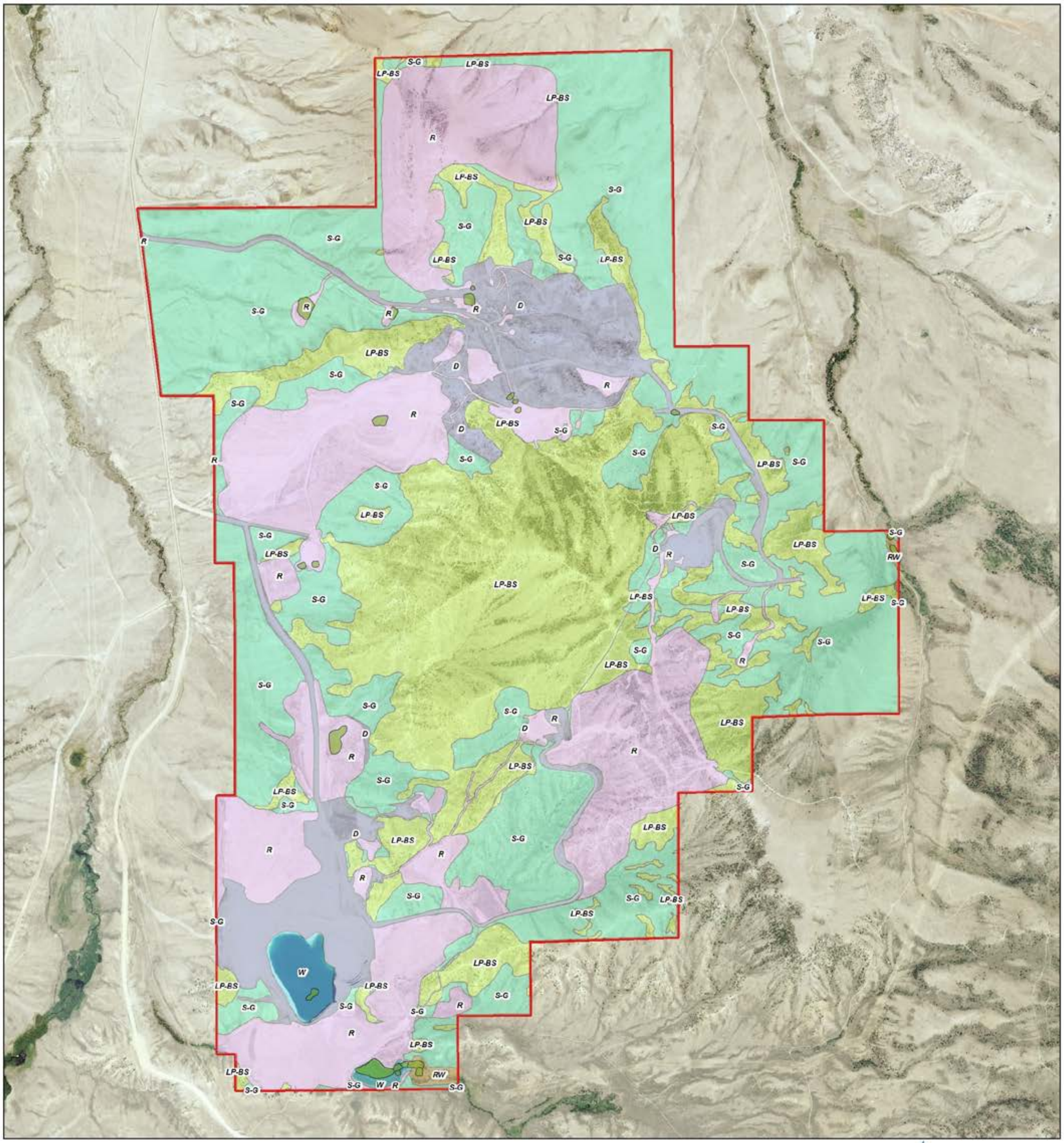
With the portion of MLRA 34A that coincides with the Project Area, there are eight ecological sites that are based on rangeland and forestland soils and vegetation within specified regions and annual precipitation zones. Land units described as an ecological site (ESD) share similar capabilities to respond to management activities or disturbance (USDA, 2006). Among other information, ESDs provide vegetation and surface soil properties of reference conditions that represent either 1) pre-European vegetation and historical range of variation in the United States, or 2) proper functioning condition or potential natural vegetation (USDA, 2003). The following are the ESDs provided by the NRCS for the Project Area:

- <u>Loamy - 15 to 19 inch Foothills and Mountains East Precipitation Zone</u>: This site type typically occurs on gently undulating rolling land and steeper slopes, located primarily on all aspects of Sheep Mountain in steep terrain, covering a total of 631.31 acres. The current vegetation community is composed of approximately 33 percent graminoids (grasses or grass-like plants), 9 percent forbs, and 58 percent shrubs.
- <u>Coarse Upland - 15 to 19 inch Foothills and Mountains Southeast Precipitation Zone</u>: These sites typically occur in the uplands on terraces and are located primarily on the ridge top and west aspect of Sheep Mountain covering a total of 464.40 acres. The current vegetation community is composed of approximately 33 percent graminoids, 9 percent forbs, and 58 percent shrubs.
- <u>Shallow Loamy - 10 to 14 inch East Precipitation Zone</u>: These sites typically occur on steep slopes and ridgetops and are located primarily in the northern part of the Project Area on all aspects and on the west aspect of Sheep Mountain, covering a total of 537.85 acres. The current vegetation community is composed of approximately 30 percent graminoids, 5 percent forbs, and 65 percent shrubs.
- <u>Coarse Upland - 10 to14 inches East Precipitation Zone</u>: These sites typically occur on undulating rolling land. They are located primarily on the east aspect of Sheep Mountain, covering a total of 115.51 acres. The current vegetation community is composed of approximately 30 percent graminoids, 5 percent forbs, and 65 percent shrubs.
- <u>Sandy - 10 to 14 inches High Plains Southeast Precipitation Zone:</u> These sites typically occur in an upland position on relatively flat to moderately sloping land. They are located primarily on the western and northeastern boarder of the Project Area covering a total of 445.94 acres. The current vegetation community is composed of approximately 29 percent grasses or grass-like plants, 8 percent forbs, and 63 percent shrubs.

- Coarse Upland - 10 to14 inches High Plains Southeast Precipitation Zone: These sites typically occur in an upland position on gentle slopes. They are located primarily on the west and east aspect of Sheep Mountain covering a total of 363.61 acres. The current vegetation community is composed of approximately 33 percent graminoids, 9 percent forbs, and 58 percent shrubs.
- Shallow Loamy - 10 to14 inches High Plains Southeast Precipitation Zone: These sites typically occur in an upland position. They are located primarily on the west aspect of Sheep Mountain covering a total of 256.17 acres. The current vegetation community is composed of approximately 28 percent graminoids, 11 percent forbs, and 61 percent shrubs.
- Loamy – 10 to 14 inches High Plains Southeast Precipitation Zone: This site type occurs on the lower eastern slope of Sheep Mountain covering a total of 35.01 acres. Potential vegetation on sites consists of 80 percent graminoids, 10 percent forbs, and 10 percent woody shrubs.
- Shallow Sandy – 10 to14 inches High Plains Southeast Precipitation Zone: This site type is present at one location within the Project Area covering a total of 17.51 acres. Potential vegetation on sites consists of 70 percent graminoids, 10 percent forbs, and 20 percent woody shrubs.
- Loamy Overflow – 10 to14 inches High Plains Southeast Precipitation Zone: These sites typically occur on gently sloping to moderately sloping canyon and a small valley bottom. They are located only on the east aspect of Sheep Mountain covering a total of 54.60 acres. The current vegetation community is composed of approximately 33 percent graminoids, 9 percent forbs, and 58 percent shrubs.
- Wetland – 10 to14 inches High Plains Southeast Precipitation Zone: This site is present at one location covering 11.87 acres which is associated with Western Nuclear Pond in the extreme south of the Project Area. Potential vegetation on wetland sites consists of 80 percent graminoids, 10 percent forbs, and 10 percent woody shrubs.

The NRCS also described “Dumps, Mine” as an ecological site with areas of waste rock derived mainly from former mining including uranium mines and quarries covering 1,267 acres (see Section 3.2.4.2 under Soils, above). The former mine sites are located throughout the entire Project Area and are typically devoid of vegetation with limited reclamation success and potential.

Vegetation communities within the Project Area were described and sampled in 1980 following guidance provided by the WDEQ-LQD, in Guideline No. 6 (Noncoal; Application for a “Permit to Mine” or an “Amendment” – WDEQ, 2003) and Guideline No. 2 (Vegetation – WDEQ, 1997). Two principal vegetation type communities and one minor vegetation type were identified within the Project Area during field surveys completed in 1980 and 1981 (BKS, 2014b). Sagebrush-Grass type dominates the vegetation community, covering 1,331 acres (37 percent) of the Project Area shown on Map 3.3-1. The Limber Pine-Big Sagebrush type community covers 967 acres (27 percent of the Project Area). A minor amount of Quaking Aspen-Grass Forb type (riparian woodland type) is associated with a riparian zone in the southeast corner occupying 0.3 percent of the Project Area. Open water covers 39 acres or 1.1 percent of the Project Area. Approximately 880 acres (24 percent of the area) disturbed by earlier mining were mapped reclaimed while 387 acres (11 percent) were mapped as disturbed ground surface.



0 1,000 2,000 3,000
Feet

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Map 3.3-1
Vegetation in Relation to the Project Area

Sheep Mountain Project Area

Vegetation
- D: Disturbed
- LP-BS: Limber Pine-Big Sagebrush
- Reclaimed
- Riparian Woodland
- S-G: Sagebrush-Grass
- Water
- NWI Wetlands

Data provided by BKS Environmental Associates, Inc. (9-3-2014)

The Sagebrush-Grass vegetation type occurs at lower elevations within the Project Area predominantly on flat to moderately-sloping concave fans of sandstone derived alluvium. Dominant species include: Wyoming big sagebrush, black sagebrush (*Artemisia nova*), rubber rabbitbrush (*Ericameria nauseosa*, formerly *Chrysothamnus nauseosus*), and Douglas rabbitbrush (*Chrysothamnus viscidiflorus*). In areas of native habitat, Wyoming big sagebrush and black sagebrush are 12 to 24 inches tall, ranging from 20 to 45 percent foliar cover. Common understory species include Sandberg bluegrass (*Poa secunda*), western wheatgrass, bluebunch wheatgrass, needle-and-thread, penstemon (*Penstemon* spp.), Hood's phlox (*Phlox hoodii*), common yarrow (*Achillea millefolium*), spring parsley (*Cymopterus acaulis*), and scarlet globemallow (*Sphaeralcea coccinea*).

At higher elevations with higher annual moisture regimes, mountain big sagebrush/mountain shrub-grasslands occurs in more productive, deeper soil sites adjacent to the Limber Pine-Big Sagebrush vegetation type. Mountain sagebrush (*Artemisia tridentata vaseyana*) and mixed mountain shrubs are 24 to 48 inches tall and range from 30 to 50 percent foliar cover. In addition to mountain big sagebrush, these areas also include a mixture of serviceberry (*Amelanchier alnifolia*), antelope bitterbrush, rabbitbrush, snowberry (*Symphoricarpos albus*), and currant (*Ribes* spp.). The understory includes common species such as western wheatgrass, bluebunch wheatgrass, Idaho fescue (*Festuca idahoensis*), kingspike fescue (*Leucopoa kingii*), Columbia needlegrass (*Achnatherum nelsonii*), penstemon (*Penstemon* spp.), Hood's phlox, common yarrow, spring parsley, arrowleaf balsamroot (*Balsamorhiza sagittata)*, shooting star (*Dodecatheon meadia*), Indian paintbrush (*Castilleja linariifolia*), wild buckwheat (*Eriogonum* spp.), and stonecrop (*Sedum* spp.).

Average vegetative cover for the Sagebrush-Grass vegetation type within the Project Area is approximately 37 percent. Litter and rock average between 25 and 37 percent, and bare ground covered between 26 and 38 percent. Annual production during the 1980 survey averaged 464 pounds per acre on the proposed affected mine area. Shrubs made up 20 percent of total ground cover, grasses made up 9 percent, perennial forbs range between 4 and 5 percent, and grasslike species made up 3 percent. Shrub heights ranged from 2 to 69 centimeters (cm) with an average of 21 cm. Heights of big sagebrush averaged 18 cm, rubber rabbitbrush averaged 33 cm, and Douglas rabbitbrush averaged 17 cm.

The Limber Pine-Mountain Big Sagebrush vegetation type occurs along ridge tops and steeper slopes in shallow to very shallow soils interspersed with rock outcrops and boulder wash. Dominant species include limber pine (*Pinus flexilis*), mountain big sagebrush, black sagebrush, Douglas rabbitbrush, and antelope bitterbrush. Less abundant shrubs include silver sagebrush (*Artemisa cana*), snowberry, and currant. The understory supports a mix of grasses and forbs including western wheatgrass, bluebunch wheatgrass, Idaho fescue, kingspike fescue, penstemon, Hood's phlox, common yarrow, spring parsley, arrowleaf balsamroot, shooting star, Indian paintbrush, wild buckwheat, and stonecrop.

Total vegetative cover within the Project Area is approximately 43 percent. Litter and rock averaged between 30 and 35 percent, and bare ground represents between 25 percent and 27 percent. Annual production measured during the 1980 survey averaged 5,801 pounds per acre on the Project Area. Shrubs made up 25 percent of the total ground cover, grasses made up 12 percent, perennial forbs made up 5 percent, grasslikes, half-shrubs, and succulents made up less than 1 percent vegetative cover in the Project Area. Rose pussytoes and hooker sandwort are the most common perennial forbs. Big sagebrush is the most abundant shrub. Limber pine and Utah Juniper (*Juniperus osteosperma*) are the two tree species present. Shrub heights ranged from 5 to 97 cm with an average height of 29 cm. Big sagebrush averaged 34 cm, black sagebrush averaged 16 cm, antelope bitterbrush averaged 23 cm, and snowberry (*Symphoricarpos* spp.) averaged 19 cm in height.

In June 2011, Limber Pine-Big Sagebrush areas were sampled using the point center quarter method (BKS, 2011b and 2014b). Limber pine had an approximate density of 17.89 trees per acre, while the Utah juniper had approximately 1.90 trees per acre. Limber pine occurrence within the Project Area is discussed in greater detail in Section 3.3.4.3, below.

The expected potential composition for this area generally ranges from 75 to 80 percent grasses, 10 percent forbs, and 10 to 15 percent woody plants. Mid cool-season perennial bunch grasses generally dominate this site, such as western wheatgrass, bluebunch wheatgrass, threadleaf sedge, prairie junegrass, and needle-and-thread. Growth of native, cool-season plants typically begins around April 15 and continues to mid-July, however, the composition and production will vary naturally due to historical use, fluctuating precipitation, and fire frequency.

The Project Area includes areas of previous mining disturbances with varied levels of reclamation. An estimated 676 acres of previously mined lands have been reclaimed within the Project Area during various periods through 2011. Reclamation through the WDEQ-AML program has reclaimed 216 acres, 38 percent of all reclaimed land as of 2011. McIntosh Pit, located in the southwest corner of the Project Area, retains water year-round but the site lacks any significant emergent or bank vegetation. The highwalls surrounding the pit are steep and lack vegetation.

The Congo Pit area, located in the northeast section of the Project Area, has been reclaimed with primarily wheatgrasses (*Agropyron spp.*), as have other disturbance areas such as the Paydirt Pit. Thickspike wheatgrass (*Elymus lanceolatus ssp. lanceolatus*), bluebunch wheatgrass, western wheatgrass, slender wheatgrass (*Elymus trachycaulus ssp. trachycaulus*), needle-and-thread, Indian ricegrass, sainfoin (*Onobrychis vicaefolia*), and Wyoming big sagebrush have been successfully established through broadcast seeding and/or drill seeding applications (Energy Fuels, 2013). Reclaimed areas (BKS, 2014b) within the Project Area are included in Map 3.3-1.

3.3.3 Wetlands and Riparian Zones

Wetlands are defined by plants, soils, and frequency of flooding, and the three identified wetland areas within the Project Area are generally classified as freshwater ponds, freshwater forested/shrub, and freshwater emergent zones. Wetlands within the Project Area were previously identified through surveys conducted in conjunction with vegetation surveys in 2010 and 2011. Additionally, a desktop analysis using the National Wetlands Inventory (NWI) data was conducted and submitted to the U.S. Army Corps of Engineers (USACE) in 2013. This NWI data set represents the extent, approximate location, and type of wetlands and deep water habitats in the conterminous United States. These data delineate the extent of wetlands and surface waters as defined by Cowardin et al. (1979) within the WDEQ-LQD Permit to Mine 381C Permit Area, as mapped on the NWI database. The 2013 desktop analysis of the NWI data indicated multiple wetlands within the Project Area. Based on the desktop analysis, the USACE requested a full aquatic resources inventory (ARI) for the Project Area to determine the presence of wetlands after disturbance from mining over the past 40 years. BKS conducted the ARI in June 2013 (BKS, 2013) and Energy Fuels submitted the findings to the USACE for review. Identification of potential wetlands was based on visual assessment of vegetation and hydrology indicators, as well as soil sampling to determine the presence of wetland criteria indicators.

The NWI data indicated nine wetlands within the proposed disturbance boundary; however, only one wetland, Sediment Control Basin-1 (also called SW-1) in Section 17, was still present during the 2013 ARI. The other eight wetlands were no longer present due to previous mining disturbances. SW-1 is an ephemeral impoundment that receives water in the spring from snowmelt or following large storm events and is dry for most of the year (Lidstone, 2013). BKS classified the wetland as a Palustrine Unconsolidated Bottom (PUBh) wetland which encompasses approximately 0.20 acre within the proposed Project disturbance areas. The dominant vegetation is sedge, Dudley's rush, Kentucky bluegrass, and water whorl grass. In addition to the 0.20 acre that make up SW-1, 0.10 acre of ephemeral drainages (R6 classification-riverine ephemeral), and 1.71 acres of other sediment control features were identified as aquatic resources within the Project Area. McIntosh Pit is not classified as a wetland due to the lack of vegetation surrounding the open water (BKS, 2013).

According to the 2013 ARI, the majority of the wetlands occur in the southeast corner of the Project Area near Western Nuclear Pond, outside the proposed disturbance boundary. Wetlands near Western Nuclear Pond are freshwater aquatic bed, palustrine emergent wetlands, and palustrine scrub-shrub which total approximately 9.10 acres. Approximately 0.29 acre of palustrine emergent wetlands occur along a tributary of Sheep Creek on the eastern edge of the Project Area, outside the area proposed for disturbance.

The USACE (2014) provided a partial jurisdictional determination for the proposed area of disturbance because there are no waters of the U.S. within the 723-acre area (see Map 3.3-2). The USACE determined that an extensive evaluation to determine jurisdiction over streams and wetlands within the Permit Area beyond the area of disturbance should not be necessary at this time because the Department of the Army authorization is not required for any uranium mining activities as defined in the WDEQ-LQD Permit to Mine 381C (WDEQ, 2015a).

In July of 2004, streams within the Sweetwater watershed were evaluated to determine Proper Functioning Condition (PFC) by the University of Wyoming on public lands. A one mile stretch of a tributary to Crooks Creek southeast of the Project Area near Crooks Creek Reservoir in Section 10 of T27N R92W, was rated as being Functional at Risk and in a downward trend (FAR-D). Two short stretches along Crooks Creek to the south of the Project Area in sections 8 and 17 of T27N R92W, were rated to be in PFC. There has been no determination of PFC on the wetlands adjacent to Western Nuclear Pond.

3.3.4 Special Status Species

3.3.4.1 ESA-Listed, Proposed, and Candidate Species

There are a total of seven threatened or endangered species included by the FWS on the Official Species List (FWS, 2016) for the Sheep Mountain Project Area dated February 22, 2016 (see Table 3.3-2). The following endangered and threatened species could occur in riverine habitats of the Platte River System downstream from the Project Area: Least tern (*Sternula antillarum*, endangered), Piping Plover (*Charadrius melodus*, threatened), Whooping crane (*Grus americana*, endangered), Pallid sturgeon (*Scaphirhynchus albus*, endangered), and Western Prairie Fringed Orchid (*Platanthera praeclara,* endangered). Ute ladies'-tresses orchid (*Spiranthes diluvialis,* threatened) and Gray wolf (*Canis lupus*, Experimental population-non essential) were also included on the Official Species List (FWS, 2016).

Yellow-billed cuckoo (*Coccyzus americanus),* listed as threatened under the ESA (FWS, 2014a), was not included on the FWS Official Species List for the Project Area and is not included in Table 3.3-1. They are considered a riparian-obligate species and are usually found in large tracts of cottonwood/willow habitats with dense sub-canopies (FWS, 2007). The route to the Sweetwater Mill does not provide suitable habitat for yellow-billed cuckoos. They are not expected in any area associated with the Project and, therefore, are not discussed further.

Table 3.3-2
U.S. Fish and Wildlife Service Official Species List[1]

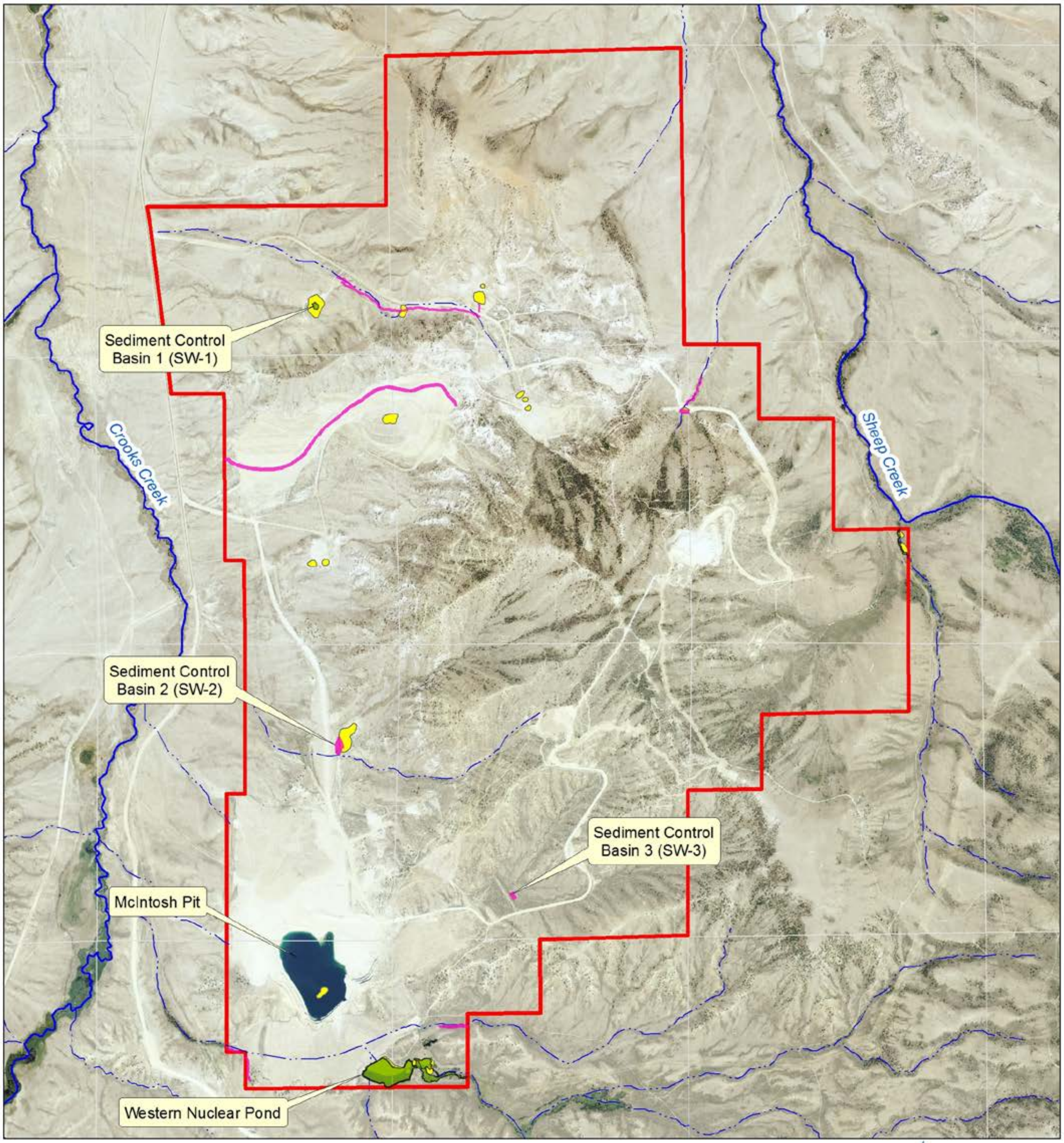
Species	Status	Has Critical Habitat
Birds		
Least tern (*Sterna antillarum)*	Endangered	
Piping Plover (*Charadrius melodus*)	Threatened	Final designated
Whooping crane (*Grus Americana*)	Endangered	Final designated
Fishes		
Pallid sturgeon (*Scaphirhynchus albus*)	Endangered	
Flowering Plants		
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	
Western Prairie Fringed Orchid (*Platanthera praeclara*)	Threatened	
Mammals		
Gray wolf (*Canis lupus*)	Experimental Population, Non-Essential	

[1] Source: FWS, 2016.

Platte River Species. The Project is located within the North Platte River Basin. Potential depletions of surface water or groundwater flowing to the river require evaluation in accordance with the 2001 decision by the U.S. Supreme Court, which established a new legal distribution of the North Platte River among Nebraska, Wyoming, and Colorado.

Ute Ladies'-tresses. Ute ladies'-tresses orchid was listed as threatened in 1992 (FWS, 1992). Populations have been reported in Niobrara, Converse, Goshen, and Laramie counties but not in Fremont County (Fertig et al., 2005). Ute ladies'-tresses inhabits seasonally flooded river terraces, subirrigated or spring-fed abandoned stream channels and valleys, and lakeshores (FWS, 1992). During the past decade, surveys for the species have located additional populations along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits, reservoirs, and other human-modified wetlands (Fertig et al., 2005).

The FWS (2013a) determined that approximately the western third of the Project Area in the vicinity of Crooks Creek and the northeastern portion in the vicinity of Sheep Creek are within the Section 7 consultation ranges for Ute ladies'-tresses orchid. Surveys were conducted from June through August, 2010 (BKS, 2011c). No habitat or individuals or populations of Ute ladies'-tresses were present within the Project Area and there were no records of the species occurring in the Project Area from the WYNDD (BKS, 2011c). The banks of Western Nuclear Pond located in Section 32 and Section 33 were dominated by foxtail barley (*Hordeum jubatum*), needleleaf sedge, and Nebraska sedge. The soil was clay, the water was stagnant, and there was no transition zone between the water and the mesic area of the banks. All of these characteristics are negative indicators for Ute ladies'-tresses habitat. The drainage leading into the pond in Section 32 from Section 33 did not have water present during the August 2010 survey; the lack of a late season water source excludes this area as potential Ute ladies'-tresses habitat (BKS, 2011c).



Map 3.3-2
Wetlands in Relation to the Project Area

N

0 4,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

Sheep Mountain Project Area
2014 Wetland Boundary
2014 R6 Drainages
Perennial Streams
Ephemeral Streams
NWI Wetlands

Gray Wolf. The gray wolf is managed under section 10(j) of the ESA as experimental, non-essential, and is currently treated as a species proposed for listing on all lands outside of National Park Service lands and National Wildlife Refuges where they are treated as threatened. The Project Area lies about 70 to 80 miles southeast of the Soda Lake pack, the closest extant pack in Wyoming. Wolves in the Soda Lake pack have been subject to harvest and control measures through 2014 (WGFD et al., 2015). Wolves have been observed in the South Wind River Mountains, east of the Project Area, but established pack(s) have not been confirmed. Once a given area is occupied by resident wolf packs, it generally becomes saturated and wolf numbers become regulated by the amount of available prey, intra-species conflict, other forms of mortality, and dispersal. Dispersing wolves may cover large areas as they try to join other packs or attempt to form their own pack in unoccupied habitat (FWS, 2009a). It is possible that a dispersing wolf from the Soda Lake pack or another pack(s) in the Greater Yellowstone Area could occur on or in the vicinity of the Project Area, given the presence of seasonal ranges used by prey species (elk, mule deer, moose - see Section 3.3.5.1, below). The Project Area is within the historical range of gray wolves although no records of occurrence are available (WYNDD, 2016).

3.3.4.2 Migratory Birds

The Migratory Bird Treaty Act (MBTA), as amended, implements treaties for the protection of migratory birds. EO 13186, issued in 2001, directed actions that would further implement the MBTA. As required by the MBTA and EO 13186, the BLM signed a MOU with the FWS in April 2010, which is intended to strengthen migratory bird conservation efforts by identifying and implementing strategies to promote conservation and reduce or eliminate adverse impacts on migratory birds. The focus of BLM’s conservation efforts are on migratory species and some non-migratory game bird species that are listed as Birds of Conservation Concern (BCC). In the MOU and pursuant to the MBTA and EO 13186, the BLM committed to consider management objectives resulting from comprehensive planning efforts (e.g., Partners in Flight Conservation Plan). BCC have been identified by the FWS (2008) for different Bird Conservation Regions (BCR) in the United States. The entire Project Area is in BCR 10, the Northern Rockies region.

Thirteen BCC species could occur within the Project Area, based on the species’ known distributions and habitat associations in central Wyoming (WGFD, 2009), and documented occurrence on-site and/or the region surrounding the Project Area. Included in Table 3.3-3 is the Conservation Priority for species identified by Wyoming Partners in Flight (Nicholoff, 2003). Only one BCC species, Brewer’s sparrow (*Spizella breweri*) was observed during on-site surveys in 2010 (Real West Natural Resource Consulting – Real West, 2011) (see Table 3.3-3). However, four other BCC species have been recorded by WYNDD within 4 miles of the Project Area (WYNDD output in 2010, Real West, 2011) and their occurrence on-site is possible. Those species include ferruginous hawk (*Buteo regalis*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike (*Lanius ludovicianus*), and sage sparrow (*Amphispiza belli*).

Long-term (1994 to 2013) population trends within BCR 10 are available for the 13 BCC species (Sauer et al., 2014) and are included in Table 3.3-3. The long-term trends within BCR 10 for Swainson’s hawk (*Buteo swainsonii*), ferruginous hawk, and peregrine falcon (*Falco perigrinus*) indicate their populations are stable. Long-billed curlews (*Numenius americanus*) are increasing in the region although olive-sided flycatcher (*Contopus cooperi*), sage thrasher (*Oreoscoptes montanus*), and Cassin’s finch (*Carpodacus cassinii*) are decreasing in BCR 10. Data compiled for 17 National Biological Survey Breeding Bird Survey routes (BBS - Sauer et al., 2014) within a 60-mile area surrounding the Project Area indicates that local populations of loggerhead shrikes have been increasing during the past 20 years, 1995 to 2014 (see Table 3.3-3). Populations of sagebrush-obligate species, sage thrashers, Brewer’s sparrows, and sage sparrows in the local area appear to have been stable (neither increasing nor decreasing) during the 20-year period.

Table 3.3-3
Birds of Conservation Concern within Bird Conservation Region 10 (Northern Rockies) that Occur or May Occur in the Project Area [1]

Common Name Scientific Name	Habitat [2]	Conservation Priority [3]	Observed On-site [4]	BCR Trend [5] 1994 to 2013	Local Trend [6] 1995 to 2014
Swainson's Hawk *Buteo swainsonii*	Nests in a tree, occasionally on a cliff; in most habitats below 9,000 feet with open areas for foraging.	Level I	No	No trend	Insufficient data
Ferruginous Hawk *Buteo regalis*	Nests in isolated trees, rock outcrops, artificial structures, ground near prey base.	Level I	No	No trend	Insufficient data
Peregrine Falcon *Falco peregrinus*	Nests on high cliff faces, often near water; forages in adjacent habitats.	Level I	No	No trend	Insufficient data
Long-billed Curlew *Numenius americanus*	Nests on the ground; often in wet-moist meadow grasslands or irrigated native meadows with aquatic areas nearby.	Level I	No	Increasing	Insufficient data
Lewis' Woodpecker *Melanerpes lewis*	Nests in a cavity of dead or lie tree in pine-juniper or other coniferous forest.	Level II	No	No trend	Insufficient data
Olive-sided Flycatcher *Contopus cooperi*	Nests often high in a conifer in forests from ≈8,000 feet to timberline.	Level II	No	Decreasing	Insufficient data
Willow Flycatcher *Epidonax traillii*	Nests in fork-branched riparian shrub, including willow, below 9,000 feet.	Level II	No	No trend	Insufficient data
Loggerhead Shrike *Lanius ludovicianus*	Nest is usually in deciduous tree or shrub in pine-juniper woodland or basin-prairie shrublands.	Level II	No	No trend	Increasing
Sage Thrasher *Oreoscoptes montanus*	Nest is concealed in or beneath a sagebrush shrub in sagebrush shrublands.	Level II	No	Decreasing	No trend
Brewer's Sparrow *Spizella breweri*	Nests in sagebrush, occasionally greasewood, rabbitbrush in shrublands.	Level I	Yes	No trend	No trend
Sage Sparrow *Amphispiza belli*	Usually nests in or under sagebrush shrub in sagebrush shrublands.	Level I	No	No trend	No trend
McCown's Longspur *Calcarius mccownii*	Nests in a depression on the ground in grasslands and basin prairie shrublands.	Level I	No	No trend	Insufficient data
Cassin's Finch *Carpodacus cassinii*	Nests in montane forests with spruce/fir and aspen; also in lower pinyon-juniper woodlands.	Level IV	No	Decreasing	Insufficient data

Notes:
[1] Species observed on-site and/or reported on one or more of 17 Breeding Bird Survey routes within 60 miles surrounding the Project Area in Fremont, Natrona, Sweetwater and Carbon counties between 1995 and 2014.
[2] WGFD, 2009.
[3] Conservation Priority from the Wyoming Bird Conservation Plan (Nicholoff, 2003).
Level I: Species needs conservation action.
Level II: Species' status requires monitoring.
Level IV: Species of concern but not considered a priority species.
[4] Real West, 2011 and 2013.
[5] Sauer et al., 2014.
[6] Linear trends of birds counted per route averaged for data available on 17 Breeding Bird Survey routes within 60 miles surrounding the Project Area in Fremont, Natrona, Sweetwater and Carbon counties between 1995 and 2014.

A total of 165 bird species listed as Nearctic and Neotropical migratory birds by the FWS, Division of Bird Habitat Conservation, and protected under the MBTA (FWS, 2010a) have been observed on the 17 BBS routes within 60 miles from the Project Area during the past 20 years. Of those 165 bird species, 133 species might occur in habitats present on or adjacent to the Project Area (see Nongame Wildlife, below) but 30 migratory bird species were observed within the Project Area during 2010 and 2011 (Real West, 2011). Trends for 13 species in the local surrounding area indicate their populations have been decreasing during the past 20 years, while populations for eight species appear to be increasing. Killdeer (*Charadrius vociferous*), Wilson's snipe (*Gallinag delicata*), mourning doves (*Zenaida macroura*), horned lark (*Eremophila alpestris*), cliff swallow (*Petrochelidon pyrrhonata*), barn swallow (*Hirundo rustica*), yellow warbler (*Setophaga petchia*), red-winged blackbird (*Aeglaius phoeniceus*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), Brewer's blackbird (*Euphagus cyanocephalus*), and American goldfinch (*Spinus tristis*) are species that have been observed within the Project Area and have declining populations in the surrounding area. Loggerhead shrikes and green-tailed towhees (*Pipilo chlorurus*) were the only species observed in the Project Area with populations that have been increasing locally during the past 20 years.

Nesting chronologies are not available for migratory bird species in the region or for those observed on-site during 2010 and 2011. For birds observed within the Project Area, the median date that migratory species arrive in Wyoming during spring is April 15. Fall migration for most species is underway by August 15 (Faulkner, 2010).

Two nesting migratory bird species seen in the vicinity of the Project Area were raptors: there was one active great horned owl (*Bubo virginianus*) nest in 2010 and one active red-tailed hawk (*Buteo jamaicensis*) nest during 2011 within 0.5 mile of the Project Area (Real West, 2011). An inactive great horned owl nest was found in an abandoned mine building. The building was removed in 2011. Three other raptor nests, in various states of repair, were found within the 0.5-mile surveyed area but none was active in 2010 and/or 2011. During 2014, a pair of red-tailed hawks nested in a former great-horned owl nest and a newly discovered red-tailed hawk on a rock pinnacle was active (Real West, 2014). In addition, prairie falcons (*Falco mexicanus*) have been observed nesting on a highwall at McIntosh Pit (Church, 2013), within the southern portion of the Project Area.

3.3.4.3 BLM and Wyoming Special Status Species

The current BLM Wyoming Sensitive Species List (BLM, 2016a) includes 37 sensitive species within the BLM Lander Field Office planning area (included in Table 3.3-4). The WGFD (2010) revised the State Wildlife Action Plan which identifies Wyoming Species of Greatest Conservation Needs (SGCN) and assigns each species at risk of population decline and/or habitat threatas/loss a Native Species Status number, 1 through 4. The State Wildlife Action Plan also assigns priorities for conservation of SGCN species ranging from Tier I, highest priority to Tier III, lowest priority. Those designations are included in Table 3.3-4.

The Project Area was surveyed for Special Status plants in 2010 (BKS, 2011c) and for Special Status animals in 2010, 2011, 2012 and 2013 (Real West, 2013). There are three species in Table 3.3-4 that are known to be present within or adjacent to the Project Area, based on field observations: Brewer's sparrow, northern leopard frog, and limber pine. Based on habitats present and species' distributions in Wyoming (WGFD, 2009) and presence within 4 miles of the Project Area as documented by WYNDD (WYNDD output in 2010, Real West, 2011, WYNDD, 2016), occurrence of four mammal species and 10 bird species are possible within the Project Area and are discussed below. Locations of BLM-sensitive plants were obtained from records maintained by the Rocky Mountain Herbarium at the University of Wyoming and WYNDD.

Table 3.3-4
BLM and Wyoming Sensitive Wildlife and Plant Species that Could Potentially Occur in the Vicinity of the Mine Project Area

Common Name Scientific Name	Habitat [1, 2]	Potential Occurrence [3, 4]	BLM Status [5]	WGFD Status [6]	WYNDD Global/State Status [7]
Mammals					
Long-eared Myotis *Myotis evotis*	Roosts in caves, buildings, mine tunnels. Found in coniferous forests, cottonwood-riparian; basin-prairie shrublands; sagebrush-grasslands.	Possible, Observed in Degree Block 18, but not observed on-site	BLM-S	NSS3 Tier II	G5/S4
Spotted Bat *Euderma maculatum*	Roosts in rock crevices. Maternity roosts are extremely sensitive to human disturbance. Known only from juniper shrublands, desert sagebrush-grasslands in Wyoming. Cliffs over perennial water, an important habitat feature.	Unlikely, No records in Degree Block 18	BLM-S	NSS3 Tier II	G4/S3
Townsend's Big-eared Bat *Corynorhinus townsendii*	Day roosts in caves, mines, rock outcrops; night roosts in buildings. Hibernates in caves. Deciduous forests, dry coniferous forests, shrublands, desert grasslands, juniper in Wyoming.	Possible, Observed in Degree Block 18, but not observed on-site	BLM-S	NSS2 Tier I	G4/S2
Pygmy Rabbit *Brachylagus idahoensis*	Nests on the ground, most likely under sagebrush, or in a burrow in dense, tall stands of big sagebrush, usually along intermittent streams or riparian areas in sagebrush-grasslands.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSS3 Tier II	G4/S1
White-tailed Prairie Dog *Cynomys leucurus*	Burrows in basin-prairie and mountain-foothills shrublands, sagebrush-grasslands, shortgrass and midgrass grasslands.	Possible, Breeds in Degree Block 18, but not observed on-site	BLM-S	None	G4/S3
Swift Fox *Vulpes velox*	Uses underground dens year-round in eastern great plains grasslands, occasionally agricultural areas, irrigated native meadows, roadside/railroad banks.	Unlikely, No records in Degree Block 18	BLM-S	NSS4 Tier II	G3/S2
Birds					
Trumpeter Swan *Cygnus buccinators*	Marshes, lakes, rivers. Nests on a muskrat house, a very small island, or a piece of floating bog.	None, No records in Degree Block 18, habitat absent	BLM-S	NSS2 Tier II	G4/S2
Greater Sage-grouse *Centrocercus urophasianus*	Basin-prairie and mountain-foothills shrublands, wet-moist meadows, alfalfa, irrigated native meadows. Nests on the ground under a sagebrush shrub.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSS2 Tier II	G4/S4
White-faced Ibis *Plegadis chihi*	Marshes, wet-moist meadows, lakes, irrigated meadows. Nests in bulrushes or cattails, occasionally on the ground on an island.	Unlikely, Observed in Degree Block 18, habitat absent	BLM-S	NSS3 Tier II	G5/S1B

Common Name **Scientific Name**	**Habitat** [1, 2]	**Potential Occurrence** [3, 4]	**BLM Status** [5]	**WGFD Status** [6]	**WYNDD Global/State Status** [7]
Bald Eagle *Haliaeetus leucocephalus*	Nests in a tree, conifers or cottonwood-riparian near large lakes and rivers. Forages in open habitats during the winter. Feeds mostly on fish; also on waterfowl, carrion.	Possible, Observed in Degree Block 18, but not observed on-site	BLM-S	NSS2 Tier II	G5/S3B
Northern Goshawk *Accipiter gentilis*	Nests in a tree in coniferous, deciduous forests, especially Douglas-fir, lodgepole pine, and aspen.	Unlikely, Record within 4 miles (WYNDD), but habitat absent	BLM-S	NSSU Tier I	G5/S3
Ferruginous Hawk *Buteo regalis*	Nests on a rock outcrop, the ground, a bank, or in a tree in basin-prairie shrublands, grasslands, rock outcrops.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSSU Tier I	G4/S4B
Peregrine Falcon *Falco peregrinus*	Nests on a ledge or in a hole on a tall cliff in most habitats. Feeds on birds.	Unlikely, Observed in Degree Block 18, but habitat absent	BLM-S	NSS3 Tier II	G4/S1B
Mountain Plover *Charadrius montanus*	Nests on the ground, somewhat exposed in short grass and mixed-grass prairie, openings in shrub ecosystems, prairie dog towns.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSSU Tier I	G3/S2
Long-billed Curlew *Numenius americanus*	Nests on the ground near water in sagebrush-grasslands; mountain foothills, and wet-moist meadow grasslands; irrigated native meadows.	Possible, Breeds in Degree Block 18, but habitat absent	BLM-S	NSS3 Tier II	G5/S3B
Yellow-billed Cuckoo *Coccyzus americanus*	Nests usually in a shrub in cottonwood-riparian below 7,000 feet, urban areas, open woodlands, streamside willow and alder groves.	None, No suitable habitat, no records in Degree Block 18	BLM-S	NSSU Tier III	G5/S1
Burrowing Owl *Athene cunicularia*	Nests in a mammal burrow, especially that of a prairie dog in grasslands, basin-prairie shrublands, agricultural area.	Possible, Breeds in Degree Block 18, but not observed on-site	BLM-S	NSSU Tier I	G4/S3
Loggerhead Shrike *Lanius ludovicianus*	Nest is usually hidden below the crown of a deciduous tree or shrub in pine-juniper woodland, basin-prairie and mountain-foothills shrublands.	Possible, Record within 4 miles (WYNDD)	BLM-S	None	G4/S3
Sage Thrasher *Oreoscoptes montanus*	Nest is concealed in or beneath a sagebrush shrub in basin-prairie shrub, mountain-foothill shrublands.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSS4 Tier II	G5/S5
Brewer's Sparrow *Spizella breweri*	Nests in a shrub in basin-prairie and mountain-foothills shrublands, especially sagebrush.	Present, observed on-site	BLM-S	NSS4 Tier II	G5/S5
Sage Sparrow *Amphispiza belli*	Usually nests in or under sagebrush in basin-prairie and mountain-foothills shrublands.	Possible, Record within 4 miles (WYNDD)	BLM-S	NSS4 Tier II	G5/S3

Common Name Scientific Name	Habitat [1, 2]	Potential Occurrence [3, 4]	BLM Status [5]	WGFD Status [6]	WYNDD Global/State Status [7]
Amphibians					
Great Basin Spadefoot *Spea intermontana*	Spring seeps, permanent and temporary waters in sagebrush communities below 6,000 feet, west of the Continental Divide.	Unlikely, No records in Degree Block 18	BLM-S	NSSU Tier I	G5/S3
Boreal Toad *Anaxyrus (Bufo) boreas boreas*	Northern Rocky Mountain Population in wet areas in foothills, montane, and subalpine zones from 8,000 to 11,000 feet.	Unlikely, No records in Degree Block 18	BLM-S	NSS1 Tier I	G4/S1
Northern Leopard Frog *Lithobates (Rana) pipiens*	Swampy cattail marshes, beaver ponds, streams, rivers, and lakes in the plains, foothills, and montane zones up to 9,000 feet.	Present, observed adjacent to site	BLM-S	NSSU Tier III	G5/S3
Columbia Spotted Frog *Rana luteiventris*	Ponds, sloughs, and small streams in the foothills and montane zones.	Unlikely, No records in Degree Block 18	BLM-S	NSS3 Tier II	G4/S3
Fish					
Yellowstone Cutthroat Trout *Oncorhynchus clarkii bouvieri*	Yellowstone River drainage, small mountain streams and large rivers. Introduced east of the Continental Divide.	None, Not in Sweetwater Drainage	BLM-S	NSS2 Tier I	G4/S2
Plants					
Meadow Pussytoes *Antennaria arcuata*	Moist, hummocky meadows, seeps, or springs surrounded by sagebrush grasslands. Present in the Sweetwater River valley, elevations 4,950-7,900 feet.	Unlikely, habitat present, but closest record 19 miles away	BLM-S	N/A	G2/S2
Porter's Sagebrush *Artemisia porter*	Sparsely vegetated badlands of ashy or tufaceous mudstones and clay slopes in the Wind River Basin, elevations 5,300-6,500 feet.	Unlikely, habitat absent, closest record 30 miles away	BLM-S	N/A	G2/S2
Dubois Milkvetch *Astragalus gilviflorus* var. *purpureus*	Barren shale, badlands, limestone, and redbed slopes and ridges in the northwest Wind River Basin, elevations 6,900-8,800 feet.	Unlikely, habitat absent, closest record 108 miles away	BLM-S	N/A	G5/S2
Cedar Rim Thistle *Cirsium aridum*	Barren, chalky hills, gravelly slopes, and fine-textured, sandy-shaley draws in Wind River Basin, elevations 6,700-7,200 feet.	Unlikely, habitat absent, closest record 15 miles away	BLM-S	N/A	G2/S2
Owl Creek Miner's Candle *Cryptantha subcapitata*	Sandy-gravelly slopes and desert ridges on sandstones of the Wind River Formation in the Owl Creek Mountains and North Wind River Basin, elevations 4,700-6,000 feet.	Unlikely, habitat absent, closest record 65 miles away	BLM-S	N/A	G2/S2
Fremont Bladderpod *Lesquerella (Physaria) fremontii*	Rocky limestone slopes and ridges in the southeastern Wind River Range, elevations 7,000-9,000 feet.	Unlikely, closest record 33 miles away	BLM-S	N/A	G2/S2

Common Name Scientific Name	Habitat [1, 2]	Potential Occurrence [3, 4]	BLM Status [5]	WGFD Status [6]	WYNDD Global/State Status [7]
Beaver Rim Phlox *Phlox pungens*	Sparsely vegetated slopes on sandstone, siltstone, or limestone substrates in the Wind River Basin, elevations 6,000-7,400 feet.	Unlikley, habitat present, but closest record 25 miles away	BLM-S	N/A	G2/S2
Rocky Mountain Twinpod *Physaria saximontana* var. *saximontana*	Sparsely-vegetated rocky slopes of limestone, sandstone, or clay in Wind River and Bighorn basins, elevations 5,600-8,300 feet.	Possible, present historically in Project Area (WYNDD)	BLM-S	N/A	G2/S2
Limber Pine *Pinus flexilis*	Timberline and at lower elevation with sagebrush. Associated species are lodgepole pine, Engelmann spruce, whitebark pine, Rocky Mountain Douglas-fir, subalpine fir, Rocky Mountain juniper, Mountain Mahogany, and common juniper.	Present, observed within Project Area	BLM-S	N/A	G4/S5
Persistent Sepal Yellowcress *Rorippa calycina*	Riverbanks and shorelines, usually on sandy soils near high water line, elevations 4,300-6,800 feet.	Unlikely, closest record 25 miles away	BLM-S	N/A	G3/S3
Barneby's Clover *Trifolium barnebyi*	Ledges, crevices, and seams on reddish-cream Nugget Sandstone outcrops in the southeast Wind River Range, elevations 5,600-6,700 feet.	Unlikely, closest record 41 miles away	BLM-S	N/A	G1G2/S1S2

Notes:
[1] Vertebrate habitat descriptions from WGFD, 2009.
[2] Plant habitat descriptions from Wyoming Rare Plant Field Guide (USGS, 2006).
[3] Potential occurrence of vertebrates in Degree Block 18, based on WGFD, 2009.
[4] Potential occurrence of plants based on locations of species in records available from the Rocky Mountain Herbarium, online at http://www.rmh.uwyo.edu/.
[5] Federal Status abbreviations: BLM-S = BLM Sensitive Species.
[6] WGFD Status: Wyoming 2010 Species with Greatest Conservation Need. Available at https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/SWAP/Wyoming-SGCN.pdf. Species ranked from NSS1 (highest) through NSS4 (lowest) were considered to be Species of Greatest Conservation Need (SGCN) in the Wyoming State Wildlife Action Plan; species identified as NSSU (Unknown) require additional information.
State Wildlife Action Plan priorities for conservation of SGCN species: Tier I – highest priority, Tier II – moderate priority, Tier III – lowest priority.
[7] Wyoming Natural Diversity Database Status:
Global Rank: G1 = Critically Imperiled, G2= Imperiled, G3= Vulnerable, G4 = Apparently Secure, G5 = Widespread, abundant.
State Rank: S1= Critically Imperiled, S2= Imperiled, S3= Vulnerable, S4 = Apparently Secure; S5 = Widespread, abundant. A “B” after the rank indicates the rank applies to Breeding Habitat; NA = Not Applicable.

<u>Mammals</u>

None of the six mammal species in Table 3.3-4 has been observed on-site. White-tailed prairie dogs (*Cynomys leucurus*) and pygmy rabbits (*Brachylagus idahoensis*) occur in the region, based on their distributions in the Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (WGFD, 2009). White-tailed prairie dogs occur along the Crooks Gap/Wamsutter Road, between US Highway 287 and the Project Area and may occur along the Crooks Gap/Wamsutter Road and Minerals Exploration Road to the Sweetwater Mill. Multiple records of pygmy rabbits within 4 miles of the Project Area are observations of burrows and fecal pellets (WYNDD, 2016).

Although no bats were reported within the Project Area during any of the wildlife surveys, species associated with mines, shafts, and adits (see species listed in Hester and Grenier, 2005) may be present and inhabit those features in the Project Area. Included are the long-eared myotis (*Myotis evotis*), spotted bat (*Euderma maculatum*), and Townsend's big-eared bat (*Corynorhinus townsendii*) (see Table 3.3-4).

Many of the BLM-sensitive bird species in Table 3.3-4 are also BCC, addressed above (Table 3.3-3 and Section 3.3.4.2). Brewer's sparrow was observed during on-site surveys in 2010 and four other species have been recorded by WYNDD within 4 miles of the Project Area and their occurrence on-site is possible including ferruginous hawk, sage thrasher, loggerhead shrike, and sage sparrow. Northern goshawk (*Accipiter gentilis*) was also reported within the 4-mile radius (WYNDD, 2016) but their occurrence on-site is unlikely due to absence of suitable nesting habitat.

<u>Greater Sage-Grouse</u>

Greater Sage-Grouse Core Area Protection (EO 2008-2), implemented first by Wyoming Governor Freudenthal in 2008, renewed in 2010 (EO 2010-4), revised by Governor Mead in 2011 (EO 2011-5), and replaced in 2015 (EO 2015-4) (State of Wyoming, 2015), established Core Population Areas (Core Area) with which new developments are managed to prevent declines in greater sage-grouse populations across the State.

On September 18, 2015, the BLM issued the Record of Decision and approved Resource Management Plan Amendment (ARMPA) for the Rocky Mountain Region including the BLM Rawlins Field Office (BLM, 2015a). This document identified three types of greater sage-grouse habitat: Sagebrush Focal Areas (SFAs), Priority Habitat Management Areas (PHMAs), and General Habitat Management Areas (GHMAs). The SFAs are important landscape blocks in the areas subject to the ARMPA with high breeding population densities of greater sage-grouse and existing high quality sagebrush. The SFAs and PHMAs together correspond to the areas identified by the State of Wyoming as Core Area. Several versions of core area have been developed. This EIS refers to version 3 which corresponds to the data in the LFO RMP. Version 4 of core area was developed summer 2015, but did not include any changes to the area analyzed in this EIS. GHMAs correspond to non-Core and are intended to provide greater flexibility for land use activities. The types of habitat in the Wyoming areas covered by the ARMPA are displayed on Map 2-1 in the ARMPA (BLM, 2015a).

The Crooks Gap/Wamsutter Road section located in the Rawlins Field Office (RFO) management area passes through lands the ARMPA identified as SFA while the Sweetwater Mill is located in lands identified as GHMA. Because the Project is located in the LFO management area and this document does not analyze any surface disturbance in lands managed by the RFO, this document uses the terms Core Area to include the SFAs in the RFO management area and non-Core Area to include the GHMA in the RFO management area.

At the closest points, the northeast border of the Project Area is 0.5 mile away and the southwest border is 0.3 mile from Core Area (see Map 3.3-3). Vehicle access to the Project Area on Crooks Gap/Wamsutter Road from US Highway 287 passes through a Core Area for 5 miles while access from the south on the Crooks Gap/Wamsutter Road crosses a Core Area for about 23 miles.

Surveys were conducted in 2010 using accepted techniques but no greater sage-grouse leks (communal mating sites) were found within 2 miles of the Project Area boundary (Real West, 2011). Leks are indicative of greater sage-grouse nesting habitats; most female greater sage-grouse nest within 2.1 to 4.8 miles from leks (Schroeder et al., 1999) although distances are highly variable (Connelly et al., 2004). Two leks within 6 miles of the Project Area were active in 2015.

Peak counts of males, averaged each year for active leks within an approximate 10-mile radius of the Project Area, indicate that the local population increased from 2002 through 2006 but it declined between 2006 and 2010. After 2010, the population remained stable or slightly increased between 2010 and 2012 but continued increase after 2013.

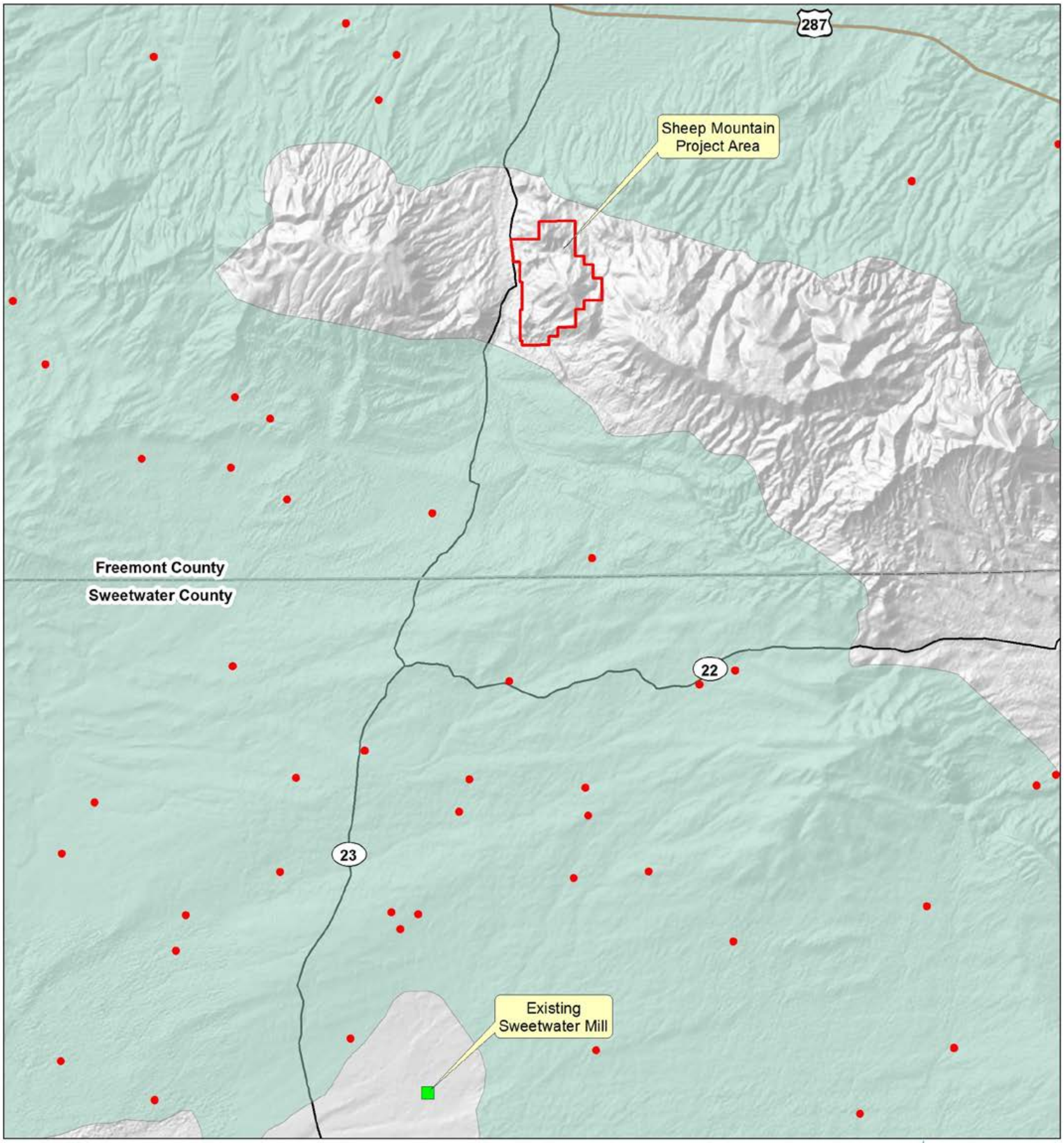
<u>Amphibians and Fish</u>

Of the four amphibian species in Table 3.3-4, the leopard frog (*Lithobates pipiens*) is the only one known to occur locally. Leopard frogs were found in Crooks Creek, approximately 0.33 mile west of the Project Area boundary (Real West, 2010). Also, leopard frogs were reported by the WGFD during 2009 and 2010 in the creek leading to Western Nuclear Pond (WYNDD, 2016), immediately south of the Project Area boundary. The only fish species in Table 3.3-4, Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*), is not found in the North Platte River Basin, including tributaries to the Sweetwater River.

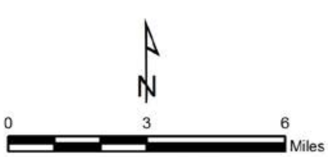
<u>Plants</u>

The WYNDD was queried for records of BLM-sensitive plant species within the Project Area but there were no occurrences (BKS, 2011c). Except for limber pine (*Pinus flexilis*), none of the other ten BLM-sensitive species of plants listed in Table 3.3-4 had been observed during surveys in 2011 although there are several historical records of Rocky Mountain twinpod (*Physaria saximontana var. saximontana*) on Sheep Mountain. According to WYNDD, Rocky Mountain twinpod (also known as Fremont County twinpod) is known from 21 extant occurrences in Wyoming, 15 of which have been relocated since 1990 (Glisson, 2004). There is a historical population on Sheep Mountain, observed in 1995, consisting of three small colonies with an estimate of 100 plants in one colony (BKS, 2011b citing WYNDD, 2003 and Glisson, 2004). The colonies occurred around elevation 6,950 feet in sandstone, limestone, and redbeds, in the Chugwater Formation on west-facing slope and the slopes were sparsely vegetated (BKS, 2011b). BKS (2011b) mapped approximately 122 acres within six polygons of potential habitat for the species in the Project Area and conducted searches for Rocky Mountain twinpod during June 2010. No individuals of Rocky Mountain twinpod were found during the on-site surveys (BKS, 2011b).

During the baseline study in the 1980s, limber pine was identified and rough species counts were conducted. The 1980s study area included the current Congo Pit disturbance area and associated haul roads. In 2010, limber pine was found throughout the Project Area and within the disturbance boundary, but most of the individuals were mainly in the central portion of the Project Area (BKS, 2011b). Limber pine habitat is located anywhere from 5,250 feet to 11,000 feet amsl in the Rocky Mountains. The species is often found on steep rocky slopes that do not support other vegetation types. The soil parent materials are derived from many types including: sandstone, limestone, granite, serpentine, quartzite, shale, obsidian, pumice, and calcareous substrates.



Map 3.3-3
Greater Sage-Grouse Core Area



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Sheep Mountain Project Area
Occupied Sage Grouse Leks
Sage Grouse Core Areas

Data provided by Wyoming Game and Fish Department (Jun 2010)

Limber pines are affected by Rocky Mountain pine beetle (*Dendroctonus ponderosae*), white pine blister rust (*Cronartium ribicola*), and limber pine dwarf mistletoe (*Arceuthobium cyanocarpum*) (Burns et al., 2011). These insect and disease agents are the leading causes of limber pine decline in the Rocky Mountains. In addition to these agents, limber pine is being affected by climate change. BLM Instruction Memorandum - IM No. WY-2011-003 established management guidelines for whitebark and limber pine in Wyoming, with the primary objective of maintaining stands on the landscape in the face of changing climate, insect infestations, and disease. IM No. WY-2011-003 was superceded by IM No. WY-2011-041 in August 2011 (BLM, 2011a).

In June 2011, Limber Pine-Big Sagebrush areas were sampled using the point center quarter method. Limber pine had an approximate density of 17.89 (sampled range from 2.73 to 107.00 trees per acre). White pine blister rust was evident on the limber pine trees within the stands surveyed. Many of the trees were succumbing to infestation and in poor health. Approximately 90 percent of the trees observed were suffering from white pine blister rust (BKS, 2011b).

3.3.5 Wildlife

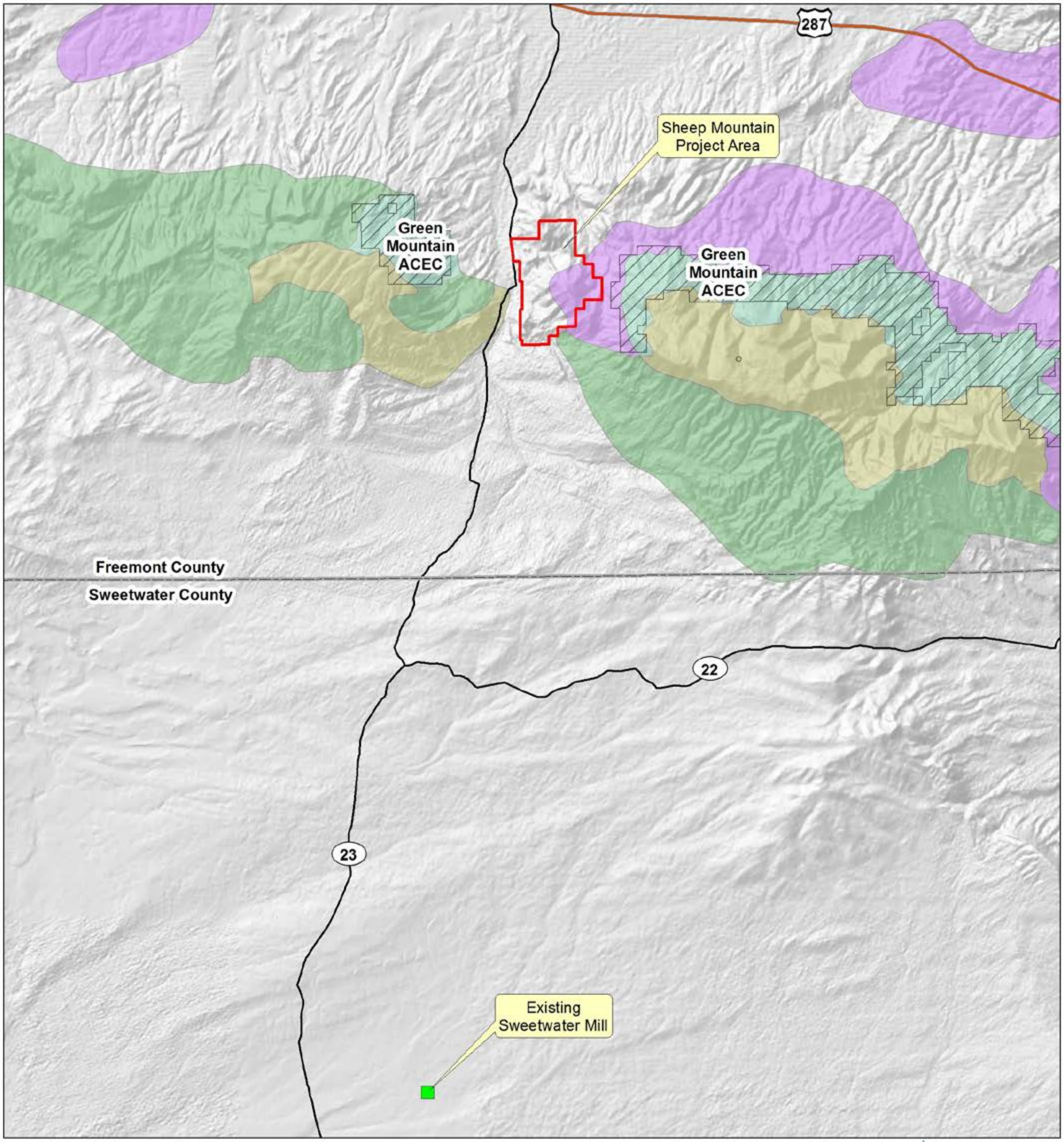
3.3.5.1 Big Game and Trophy Game

Four big game species occur within the Project Area: elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and moose (*Alces alces*). Trophy game species potentially present include mountain lion (*Felis concolor*) and black bear (*Ursus americanus*). Data summarized below were compiled from WGFD Annual Big Game Herd Unit Reports from 1991 through 2014 and Annual Reports of Big Game and Trophy Game Harvest for the same period.

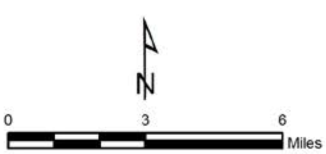
Elk within the Green Mountain Herd Unit (the local population area) inhabit winter range on the eastern third of the Project Area. The Green Mountain Herd Unit covers southeastern Fremont County, southwestern Natrona County, and small portions of adjoining Sweetwater and Carbon counties (see Map 3.3-4). Elk occupy winter range from November 15 through April 30. The remaining Project Area is not elk seasonal habitat. Crucial winter-yearlong range is 0.55 mile east of the Project Area boundary. Vehicle access to the Project Area on Crooks Gap/Wamsutter Road from US Highway 287 does not cross any seasonal habitats occupied by elk. Access from the south on the Crooks Gap/Wamsutter Road does not cross occupied habitat.

The Green Mountain elk population objective has been 500 animals since 1992 but the most recent estimated population for the herd unit was 1,400 elk in 2005. WGFD population estimates indicate the population had been increasing between 1991 and 2005. Harvest of cows and juveniles was reduced after the severe winter of 1992-1993. An average of 237 elk have been harvested annually within the Green Mountain Herd Unit during the past 20 years, 1995 to 2014 but annual harvest has been increasing, overall, during that period, including harvest of cows and calves.

Mule deer within the Sweetwater Herd Unit utilize different portions of the Project Area during different seasons: as winter-yearlong range in the southern two-thirds and as yearlong range in the northern third (see Map 3.3-5). Vehicle access to the Project Area on Crooks Gap/Wamsutter Road from US Highway 287 crosses a portion of yearlong habitat but mostly crosses unoccupied habitat for 5.6 miles. Access from the south on the Crooks Gap/Wamsutter Road crosses winter-yearlong habitat for 3.7 miles and yearlong habitat for 2.2 miles but most of the road crosses unoccupied habitats. According to WGFD herd unit maps, mule deer utilize Crooks Gap as a migration route from southern yearlong ranges to northern winter range in the vicinity of the Sweetwater River. The Sweetwater Herd Unit covers southeastern Fremont County, southwestern Natrona County, and small portions of adjoining Sweetwater and Carbon counties.



Map 3.3-4
Elk Seasonal Ranges



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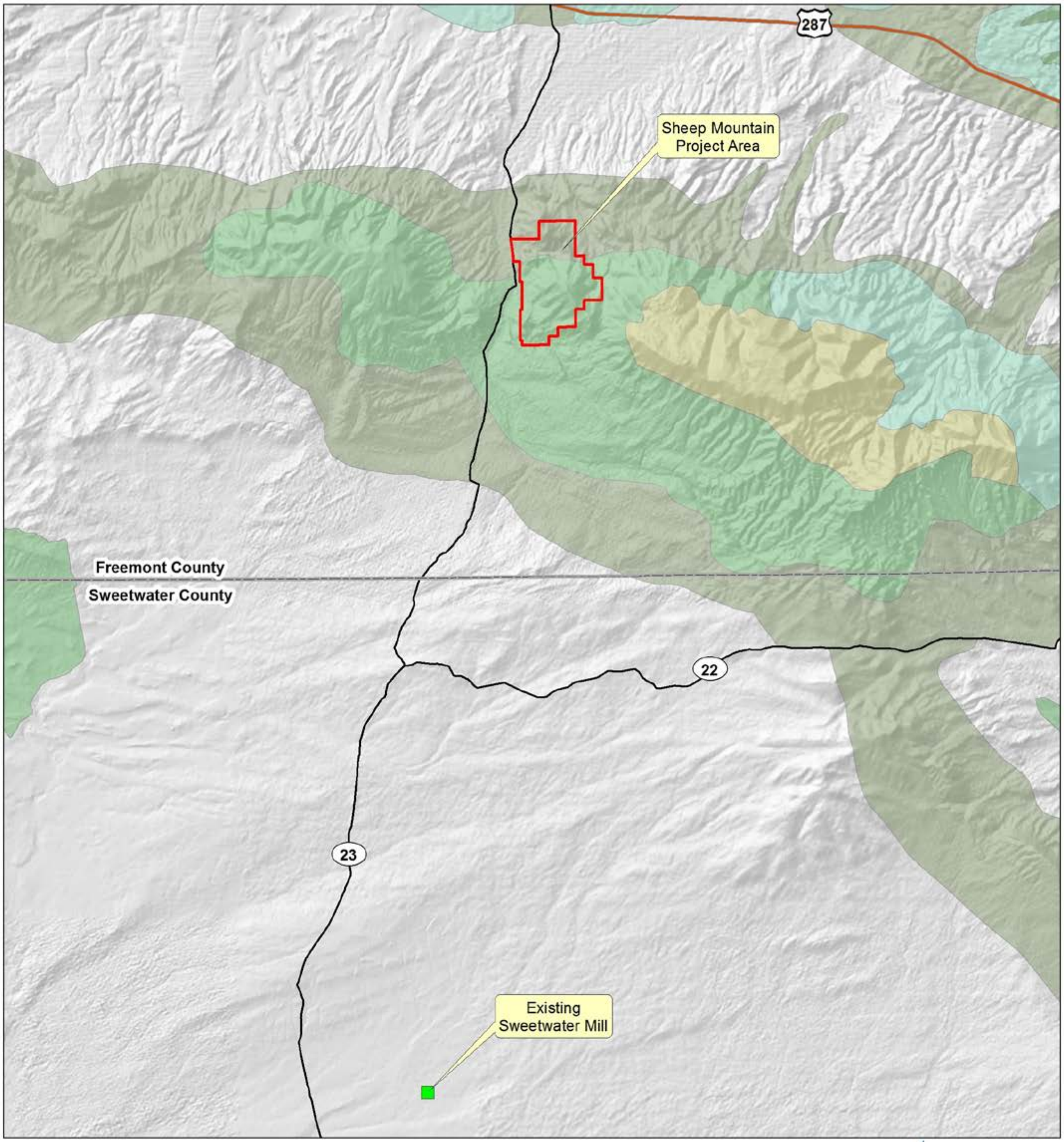
Sheep Mountain Project Area
Areas of Critical Environmental Concern
Crucial Winter Year Long
Spring-Summer-Fall
Winter
Winter Year Long

Data provided by Wyoming Game and Fish Department (Nov 2013)

The estimated post-harvest mule deer population has steadily increased during the past 15 years, 1997 to 2009, in large part due to an increasing trend in fawn recruitment with the 20-year average of 0.695 fawn per doe (69.5 fawns per 100 does). However, the population declined since 2010 with declining fawns per does until 2014 when 95.1 fawns per 100 does were documented. The estimated post-harvest population in the Sweetwater Herd Unit was 3,400 deer in 2014, above the previous year's estimate of 2,474. The recent population decline was attributed to drought conditions from winter 2011 through spring and summer 2012 (Harter, 2013a). The population objective is 6,000 deer. Harvests of does and fawns were eliminated when the population was reduced by severe winter conditions in 1992-1993. Harvest of bucks remained low until 2005; as the post-harvest population returned to the objective level, harvest of all sex and age groups (including harvest of does and fawns) increased through 2011 but decreased in 2012. The post-season ratio of 0.654 fawn per doe in 2012 was the lowest productivity reported for the herd unit since 2006 but productivity dramatically increased in 2014 with improved habitat conditions following consecutive years of drought.

Pronghorn occupying the northern half of the Project Area are within spring-summer-fall and winter-yearlong ranges in the Beaver Rim Herd Unit; pronghorn in the southern half occupy winter-yearlong range within the Red Desert Herd Unit (see Map 3.3-6). Vehicle access to the Project Area on Crooks Gap/Wamsutter Road, from US Highway 287, passes through crucial winter-yearlong habitat for pronghorns in the Beaver Rim Herd Unit habitat for approximately 3.7 miles. Access from the south, on Crooks Gap/Wamsutter Road, passes through winter-yearlong habitat with the exception of a 1-mile segment through crucial winter range near Interstate-80. According to WGFD herd unit maps, pronghorn in the Red Desert Herd Unit utilize Crooks Gap as a migration route to and from northern crucial winter-yearlong range to southern winter-yearlong habitats in the Great Divide Basin. The Beaver Rim Herd Unit covers most of southern Fremont County and southwestern Natrona County. The Red Desert Herd Unit is within northeastern Sweetwater County, extending to adjoining south Fremont County and northwest Carbon County.

The post-harvest population in the Beaver Rim Herd Unit has been below the objective of 25,000 animals (10 year average of 22,432 pronghorn) while the post-harvest population in the Red Desert Herd Unit has averaged 12,766 during the past 10 years, below the population objective of 15,000 pronghorn. Fawn production in both herd units had been slightly increasing during the past 20 years until 2012 when productivity in the Red Desert Herd Unit was the lowest on record since 1993 (0.417 fawn per doe) and the lowest since 1995 in the Beaver Rim Herd Unit (0.471 fawn per doe). Productivity in both populations increased through 2014 in response to improved habitat conditions and precipitation. The total pronghorn harvest in both herd units was dramatically reduced in 1995 following severe winters. Harvest has remained low in the Red Desert Herd Unit, averaging 550 since 1995 but pronghorn harvest has been increasing in the Beaver Rim population since 1995. Harvest was lower in 2012. Drought conditions through 2012, as described for mule deer, affected pronghorn productivity and population growth in both herd units but recent precipitation has led to improved habitat conditions with concomitant population responses.



Map 3.3-5
Mule Deer Seasonal Ranges

0 3 6 Miles

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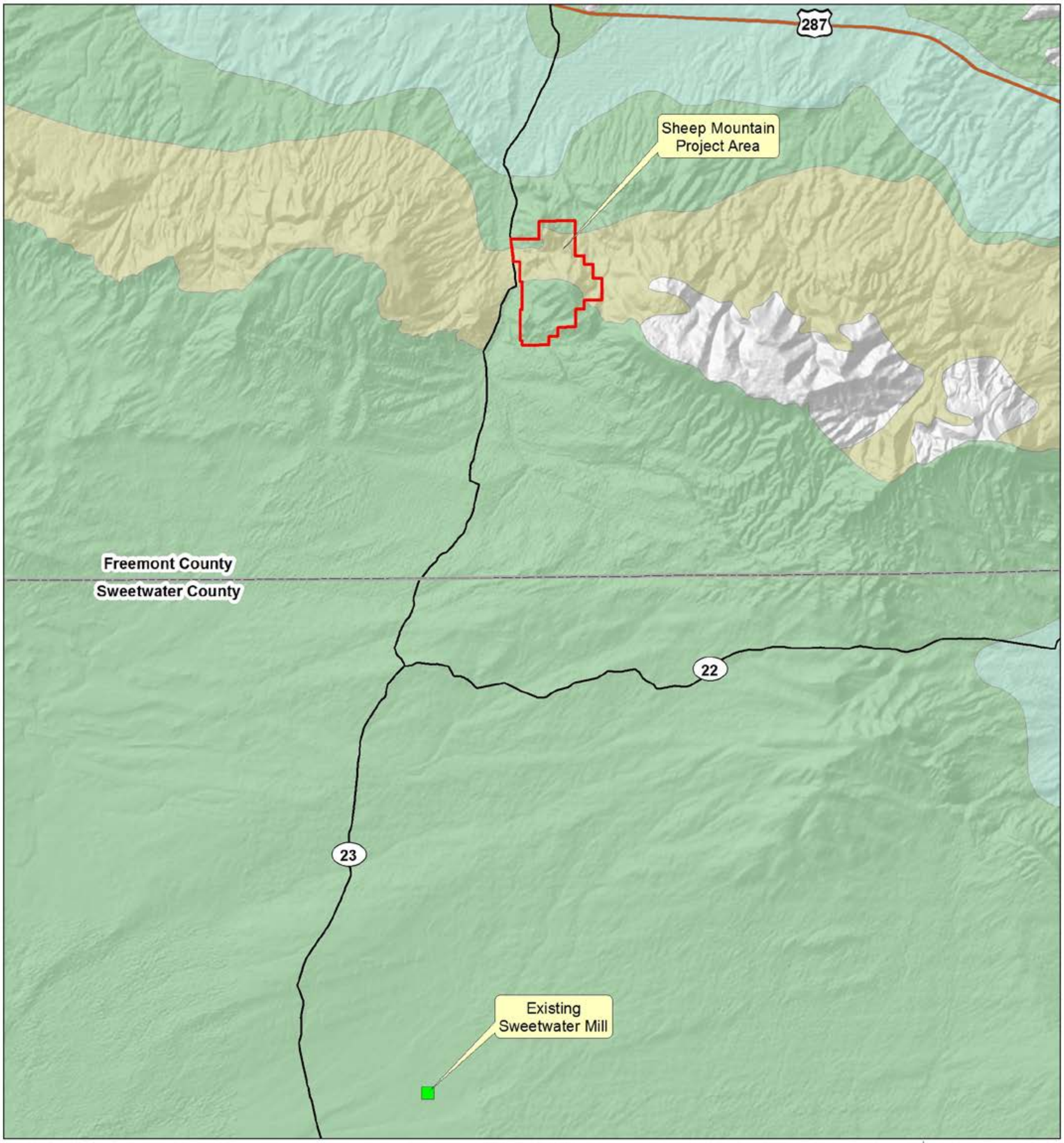
- Sheep Mountain Project Area
- Crucial Winter Year Long
- Spring-Summer-Fall
- Winter Year Long
- Year Long

Data provided by Wyoming Game and Fish Department (Nov 2013)



Map 3.3-6
Pronghorn Seasonal Ranges

0 3 6
Miles

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Sheep Mountain Project Area
Crucial Winter Year Long
Spring-Summer-Fall
Winter Year Long

Data provided by Wyoming Game and Fish Department (Nov 2013)

Moose in the Lander Herd Unit occupy spring-summer-fall range in the south and western portions of the Project Area (see Map 3.3-7). The Lander Herd Unit extends across southern Fremont Count and into southwestern Natrona County, extreme northwest Carbon County, northern Sweetwater County, and southeast Sublette County. The Lander Herd Unit post-harvest population objective was recently adjusted to 225 animals, the 2014 estimate was 113 moose. The population appeared to decline in 2005 and has remained below 400 animals through 2011 (no population estimate is available for 2012). Annual harvest has averaged 25 moose during the 20-year period, 1995 to 2014, although harvest has been reduced to bulls-only since 2005 due to the earlier population decline. The parasitic carotid artery worm (*Elaephora schneideri)* infects most moose populations throughout Wyoming but has not yet been found in the Lander Herd Unit (Harter, 2013b). Severe cases of winter ticks (*Dermacentor albipictus*) may be adversely affecting moose in this herd unit; ticks have adversely affected moose throughout their range in North America (Samuel et al., 2000).

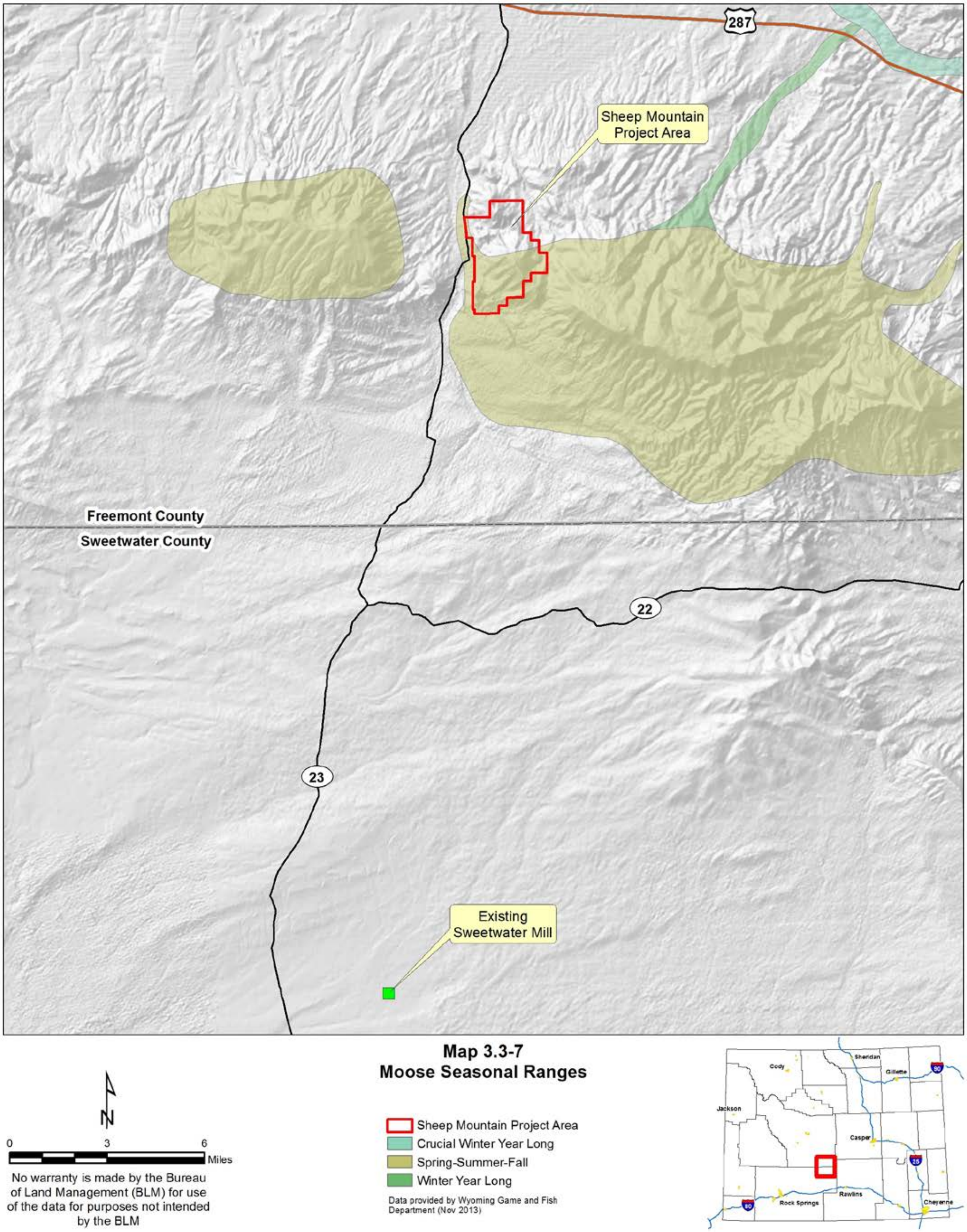
Mountain lions that could occur within the Project Area are within the Gas Hills Hunt Area. No population estimates are available. The WGFD has an annual harvest quota of six mountain lions for the hunt area but the quota has only been attained two times from 2006 to 2015.

Black bears may occur in the project vicinity but WGFD has not defined a management area for the species and there are no harvest data available for the region surrounding the Project Area. Black bears have been observed on Green Mountain in the past.

3.3.5.2 Upland Game Birds, Small Game and Furbearers

The Project Area coincides with two Small and Upland Game Management Areas (SUGMA 8 and 9) that were consolidated in 2010, along with four other areas, to form SUGMA 6. SUGMA 8 and 9 cover southern Fremont County, northern Sweetwater County, and adjacent areas in Natrona and Carbon counties. Seven upland game bird species have been harvested within SUGMA 8 and 9. Two of the species, mourning dove and ruffed grouse (*Bonasa umbellus*), were observed within the Project Area during 2010 (Real West, 2011) and the sagebrush-grassland habitat present is suitable for greater sage-grouse, also discussed as a Sensitive Species, above. Greater sage-grouse harvest data in Management Area E and Area H indicates there had been a significant declining trend in total birds harvested per hunter day from 2006 through 2014 (also see discussion in Section 3.3.4.3). Harvest data for mourning doves and ruffed grouse were consistently reported for SUGMA 8. From 2002 through 2014, fewer and fewer ruffed grouse had been harvested per hunter day, but harvest of mourning doves was consistent, averaging 3.8 birds per day. Those data were compiled from WGFD Small and Upland Game Annual Harvest Reports for 2001 through 2014. Blue grouse (*Dendragapus obsucrus*) have also been harvested in SUGMA 8 although their occurrence in the Project Area is unlikely, given the limited suitable habitat.

Harvest of rabbits, most likely desert cottontail (*Sylvilagus audubonii*), has been relatively consistent averaging 1.6 rabbits harvested per hunter day within SUGMA 8 and 9, combined (as SUGMA 6) from 2002 to 2014. Desert cottontails were observed within the Project Area during recent on-site surveys (Real West, 2011). Coyote (*Canis latrans*) is the only furbearer species observed in the Project Area although other furbearers including bobcat (*Lynx rufus*), badger (*Taxidea taxus*), weasels (*Mustella erminea* and *Mustela frenata*), and skunks (*Mephitis mephitis* and *Spilogale putorius*) are expected, given the habitats present within the Project Area. Aquatic-dependent furbearers - beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), or mink (*Mustella vison*) - potentially occur in Crooks Creek, approximately 0.25 mile west of the Project Area.



Map 3.3-7
Moose Seasonal Ranges

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Data provided by Wyoming Game and Fish Department (Nov 2013)

3.3.5.3 Migratory Game Birds

Migratory game birds (including waterfowl) are protected under the MBTA of 1918, discussed above. The Project Area is within Waterfowl Management Area (WMA) 4D which coincides with the Central Flyway, east of the Continental Divide in Wyoming. Very few ducks and geese are harvested in WMA 4D compared to other management areas within the Central Flyway. Habitat for waterfowl within the Project Area is limited to McIntosh Pit and Western Nuclear Pond (Real West, 2011). A few Canada geese (*Branta canadensis*) were observed at McIntosh Pit during spring, 2010. There is no emergent vegetation or riparian vegetation in the pit and water is alkaline (pH > 7). Selenium concentrations exceed 2 µg/l. Selenium concentrations in water (>2 µg/l) are considered toxic to vertebrates, including waterfowl (Peterson and Nebeker, 1992; Lemly, 1996; Bureau of Reclamation et al., 1998). Green-winged teal (*Anas carolinensis*) and common mergansers (*Mergus merganser*) were seen on Western Nuclear Pond, which is likely utilized by other waterfowl as well (Real West, 2011).

3.3.5.4 Non-Game Wildlife

Wildlife surveys within the Project Area were conducted in April 1974. Results from that survey were augmented by observations from a study conducted by the WGFD in south central Wyoming during 1980 in habitats similar to those in the Project Area (see Real West, 2011). As stated (Real West, 2011), it was “assumed that the animal density information for vegetation types in southwest Wyoming can be extrapolated to similar vegetation types in the Crooks Gap Area.” The information from those studies, along with surveys conducted in 2010 and 2011, suggested that various nongame wildlife (not including game species or Special Status Species) might be found in habitats within or adjacent to the Project Area including 32 species of mammals and 133 species of birds, all of them migratory species protected under the MBTA (see above). In addition, WGFD (2009) reported two species of lizards, three species of snakes, one salamander and three frog species (one of them a Special Status Species) that have been observed within the region surrounding the Project Area. Northern leopard frog (*Rana pipiens*) and boreal chorus frogs (*Pseudacris maculata*) occur in Crooks Creek, approximately 0.25 mile west of the Project Area and chorus frogs inhabit Western Nuclear Pond (Real West, 2011).

3.3.5.5 Fisheries

Noted above, water impounded in McIntosh Pit is likely to be unsuitable for fish and other aquatic organisms due to the presence of selenium and absence of aquatic vegetation. However, the WGFD have stocked Western Nuclear Pond with brook trout (*Salvelineus fontinalis*) and rainbow trout (*Onchorhynchus mykiss*) annually since 1990. The WGFD stocked the pond with largemouth bass (*Micropterus salmoides*) in 2011. Sampling was conducted in June 2013 which yielded brook trout, largemouth bass, rainbow trout, white suckers (*Catostomus commersonii*), and fathead minnows (*Pimephales promelas*) that were probably introduced by the public (Real West, 2013).

The reservoir is on private land inside the southern boundary of the Project Area but has been accessible to the public and is managed as a basic yield fishery (see Appendix B in Real West, 2011). Also, native fish species occur in Crooks Creek, a tributary to the Sweetwater River with intermittent flows between Crooks Gap and the river. Creek chub (*Semotilus atromaculatus*), long nosed dace (*Rhinichthys cataractae*) and white sucker have been found in the creek in the vicinity of Crooks Gap, west of the Project Area, along with non-native brook trout (Real West, 2011). Crooks Creek is classified by the WGFD as a Class 3 trout stream, an important regional fishery in the state (BLM, 2013a).

3.3.6 Wild Horse and Burros

The BLM protects, manages, and controls wild horses and burros under the authority of the Wild Free-Roaming Horses and Burros Act of 1971. This law ensures that healthy herds thrive on healthy rangelands. Most wild horses in the nation are found on BLM-administered lands. The BLM is responsible for managing the size and distribution of the herds. While wild horses (there are no free-roaming burros in the Lander area) are of particular interest to the public, wild horses compete with other grazing species for forage within their range.

The BLM designated wild horse herd areas, carried forward without modification in the 2013 RMP (BLM, 2013a) with approximately 1,000 horses in seven herd management areas (HMAs). Population numbers (called HMA Appropriate Management Levels) are in accordance with the 2003 Consent Decree in litigation brought by the State of Wyoming against the BLM. The Decree was valid for 10 years and is set to terminate in 2013. Additional information regarding the wild horse program in the LFO can be found in the FEIS for the Lander RMP (BLM, 2013a).

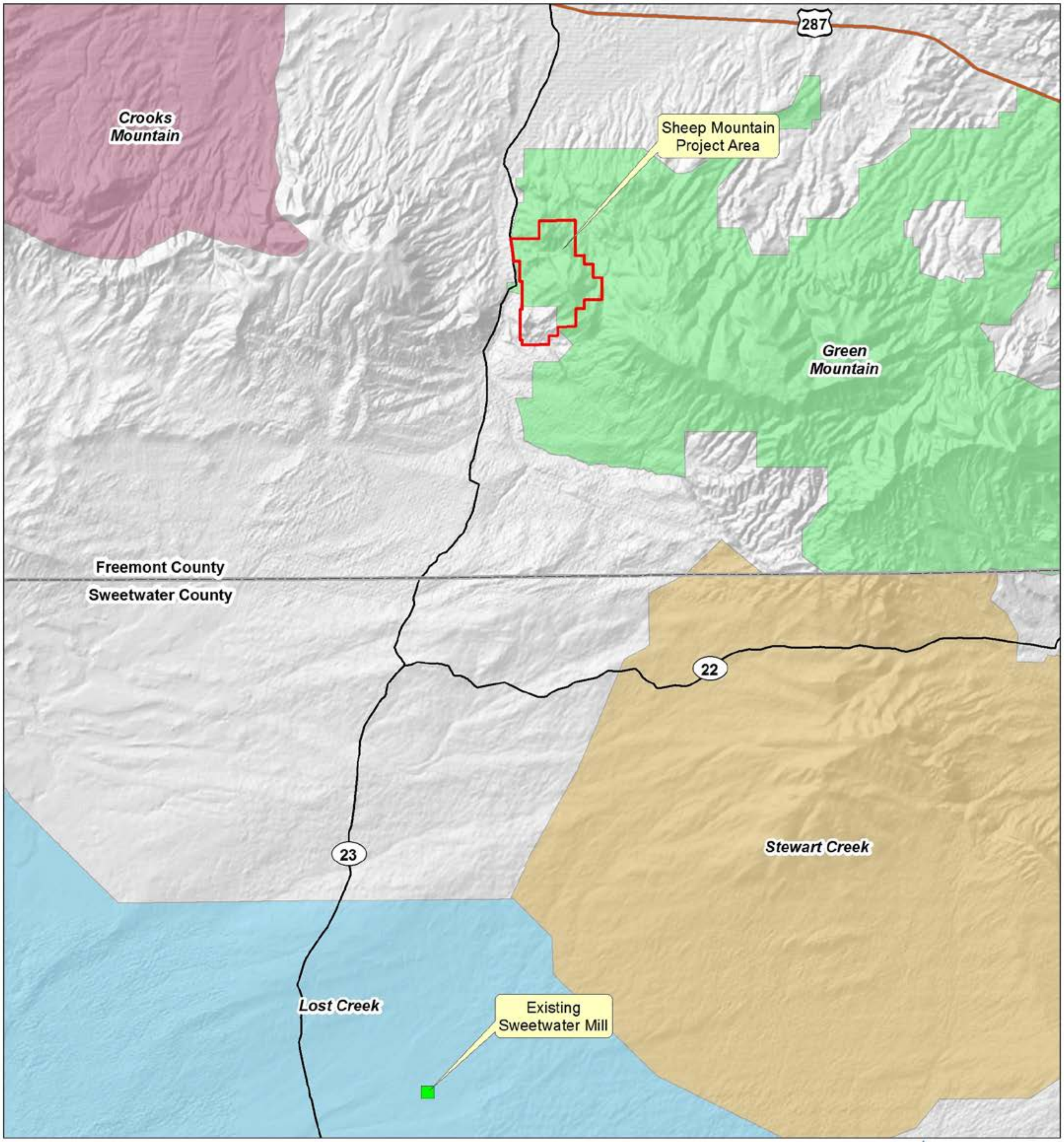
The Green Mountain HMA (116,680 acres of which 99,231 acres are federal surface) coincides with 2,932 acres of the Project Area (see Map 3.3-8). The Green Mountain HMA Appropriate Management Level is 170 to 300 horses, and the current number of horses within the HMA is estimated to be 456 (Fluer, 2013). Crooks Mountain HMA, about 5.7 miles to the west of the Project Area, consists of 58,425 acres of which 54,726 acres are federal surface. The Appropriate Management Level for this herd management area is 65 to 100 horses, and the current number of horses within the HMA is estimated to be 167 (Fluer, 2013).

Wild horses graze on the range throughout the year. The BLM uses an animal unit month (AUM) of 1.15 for horses (as compared to 1 AUM for a cow/calf for domestic livestock). With few natural predators, wild horses have a reproduction rate of approximately 20 percent per annum in typical weather years (in times of drought and other types of severe weather, this rate may be lower). There is some limited predation of the Crooks and Green Mountain HMAs by mountain lions.

Population control within the range of HMA Appropriate Management Level is maintained by periodic gathers in which the health of the population is assessed and animals removed as needed to maintain the Appropriate Management Level. Fertility control is administered to the mares by anti-fertility drugs. In the past, this has been most often the vaccine Porcine Zona Pellocida, which has declining effectiveness over time. By the fourth year following injection, the drug has only limited utility.

Table 3.3-5 identifies the wild horse removals from the Green Mountain and Crooks Mountain HMAs since 1980.

Indicators of health for wild horses can be broken down into two main areas: the health of the horses and the vegetative health of the habitat in which they live. Each is a reflection of the other. Wild horses are adversely impacted by the loss or degradation of vegetation in their habitat. While wild horses have adapted to avoid humans and generally spend their time loafing and grazing on higher ground to facilitate surveillance of the surrounding areas, they do visit riparian areas for water and to consume riparian vegetation which during the hotter months is more palatable than upland vegetation.



Map 3.3-8
Green Mountain Herd Management Area

0 3 6 Miles

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

Sheep Mountain Project Area

Herd Management Areas

- Crooks Mountain
- Lost Creek
- Green Mountain
- Stewart Creek

Data provided by Bureau of Land Management, Lander Field Office (Aug 2010)

Table 3.3-5
Wild Horse Removals from the Green Mountain and Crooks Mountain HMAs since 1980

Year	Numbers Removed
Green Mountain HMA	
1980	255
1984	199
1993	318
1995	88
1996	105
1997	145
2002	155
2003	75
2005	490
2006	89
2009	330
2012	240
Crooks Mountain HMA	
1985	708
1996	319
1998	220
2002	103
2006	74
2009	0
2012	17

Wild horses are adversely impacted by fences; even when the horizontal fence rails are removed to facilitate wildlife movement, wild horses will avoid the vertical fence posts as if movement were still blocked.

Wild horses move outside of the HMAs where topography and fencing allow which supports genetic intermingling between the Crooks Mountain HMA and Green Mountain HMA herds as well as with other HMAs. Wild horses also migrate from winter protection areas to other locations for parturition and summer grazing.

Wild horse-vehicle collisions are relatively rare. The BLM does not have any recorded incidences of wild horse harassment by humans.

3.4 HERITAGE RESOURCES AND HUMAN ENVIRONMENT

3.4.1 Cultural Resources

The BLM manages cultural resources on public lands in accordance with the Antiquities Act of 1906, National Historic Preservation Act (NHPA) of 1966, Native American Graves Protection and Repatriation Act of 1990, the Archaeological Resources Protection Act of 1979, and various other laws and Executive Orders. The BLM also implements the procedures identified in Wyoming BLM's 2006 Protocol with the State Historic Preservation Officer (SHPO), as part of the BLM's National Programmatic Agreement with the Advisory Council on Historic Preservation.

Cultural resources span approximately 11,500 years in the Rocky Mountain west (BLM, 2011b). The region encompassing the Project Area contains prehistoric and historic sites and traditional cultural places. Examples of known cultural resources in the area include, but are not limited to, lithic scatters, camps, trails, and a stage station.

LTA, Inc. (LTA) conducted a files search at the Wyoming Cultural Records Office and included National Register of Historic Places (NRHP) listings and General Land Office plats. The NRHP is an official federal list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. National Register properties have significance to the history of their community, state, or the nation. The files search encompassed approximately 11 square miles, covering all public lands survey sections containing the Project Area (Sections 15, 16, 17, 20, 21, 22, 27, 28, 29, 32, and 33). The search indicated a fairly high density of prehistoric materials along and parallel to the major drainages that border Sheep Mountain, including Crooks Creek to the west and Sheep Creek to the east. The findings also show six previous cultural resource inventories, including approximately 1,570 acres in the vicinity of the Project Area. Nearly all of this land is within the Project Area. Twenty-three sites have been recorded in or within the vicinity of the Project Area. Previously recorded sites within the vicinity of the Area of Potential Effect (APE) are summarized in Table 3.4-1. Two of these sites, 48FR80 and 48FR256, are within the Project Area. Site 48FR256 consists of prehistoric hearth remains discovered adjacent to the Crooks Gap/Wamsutter Road. The site is listed in the Cultural Records Office database as destroyed. Site 48FR80 is marked as a stone circle site but field visits confirmed it to be only natural features.

There are seven previously recorded historic properties within the vicinity of the Project Area that have been determined eligible for inclusion in the NRHP with Wyoming SHPO concurrence. An eighth site, 48FR1864, was evaluated by the recorder as eligible. None of these sites are within the Project Area. An additional site, recorded in 2013, is within the Project Area boundary (48FR7357, described below) and was recently determined to be ineligible for inclusion in the NRHP. All of the sites are described in full detail in the 2010 and 2013 cultural survey reports (Larson, 2010 and Larson and Hooten, 2013), which also includes a list of previous cultural surveys in the area. Two of the eligible sites, the Rawlins to Fort Washakie Road (48FR415), and the Crooks Gap Stage Station (48FR1435), are historic era resources. The historic-era is usually defined as beginning with the first contact between Euro-Americans and Native Americas. The end of the historic era is fluid and generally defined as at least 50 years old. The two sites were the subjects of visual contrast assessments, which are also described below.

LTA also engaged in three separate Class III surveys on approximately 81.5 acres (Larson, 2010), 121 acres (Eckles and Larson, 2011), and 168 acres (Larson and Hooten, 2013) within and adjacent to the Project Area. The inventory areas were inspected on foot with field personnel spaced no more than 30 meters apart. No forms of artifact collection or subsurface testing took place. The selection of inventory areas and other matters related to the cultural resource investigations are the result of LTA correspondence with the BLM LFO's cultural resource staff and subsequent meetings. A total of 11 Class III cultural resource inventories have been conducted within the WDEQ-LQD Permit to Mine 381C Permit Area and/or along the linear utility and dewatering lines leading into the area since 1979.

In 2014, an additional 92.2 acres were inventoried for cultural resources by LTA (Larson, 2014). These cover areas of proposed project disturbance were not examined for cultural resources under the previous inventories within the Project Area. These new acres include 46.8 acres of BLM-administered land and 45.4 acres of state land, and bring the total acres inventoried for this Proposed Action to 462.7 acres. The 2014 inventory recorded only one isolated find and determined that there is very little chance subsurface materials are present in the area (Larson, 2014).

Table 3.4-1
Previously Recorded Sites in the Vicinity of the Proposed Action APE

Site Number	Site Type	NRHP Eligibility
48FR80	Stone Circles (Natural Features)	Not Eligible
48FR256	Fire Hearth	Destroyed
48FR415	Rawlins to Fort Washakie Trail	Eligible, contributing (Segments 2 and 4) and noncontributing segments recorded
48FR1356	Crooks Gap Oil Field	Not Eligible
48FR1435	Crooks Gap Stage Station	Eligible
48FR1470	Prehistoric Lithic Scatter	Not Eligible
48FR1471	Prehistoric Lithic Scatter	Not Eligible
48FR1476	Prehistoric Lithic Scatter	Not Eligible
48FR1864	Prehistoric Feature, Fire Hearths	Eligible
48FR2641	Prehistoric Lithic Scatter	Not Eligible
48FR3293	Prehistoric Lithics, Fire Hearths	Eligible
48FR3503	Prehistoric Lithic Scatter	Not Eligible
48FR4221	Prehistoric Lithics, Fire Hearths	Eligible
48FR4222	Prehistoric Lithics, Fire Hearths	Not Eligible
48FR4223	Prehistoric Lithics, Fire Hearths	Not Eligible
48FR5123	Prehistoric Lithics, Fire Hearths	Not Eligible
48FR5124	Prehistoric Lithics, Fire Hearths	Not Eligible
48FR5125	Prehistoric Lithics, Fire Hearths	Eligible
48FR6259	Prehistoric Feature, Fire Hearths	Unknown
48FR6260	Prehistoric Lithics, Fire Hearths	Eligible
48FR6261	Prehistoric Feature, Fire Hearths	Eligible
48FR6262	Prehistoric Lithics, Fire Hearths	Not Eligible
48FR6496	Prehistoric Lithic Scatter, Historic Debris	Not Eligible

The field search for the previously recorded archaeological site 48FR80 was unsuccessful. BLM personnel also attempted to relocate the stone circle 48FR80 and found what appears to be the original site datum. However, no stone circles or other cultural materials were found and only natural rocks and boulders occur in the reported vicinity of the site. As a result, this site is now considered not eligible for listing on the NRHP.

Site 48FR7357 is within an area of proposed potential disturbance west of the proposed processing facility. This site is thought to be the Continental Materials Corporation mine camp and office area. Wyoming SHPO recently determined that the site is not considered to be eligible for inclusion on the NRHP and that the proposed mining operations would have no effect on the site. It is one of the few, if not only, surviving mine camps from the early 1954 to 1957 phase of exploration and small-scale mining in the Sheep Mountain/Crooks Gap area. While the structural remains at 48FR7357 are relatively common utilitarian designs with little or no architectural merit, the foundations are well preserved.

The historical Rawlins to Fort Washakie Road is eligible for listing on the NRHP. Two contributing segments (meaning, that the segments each contribute attributes that make the road NRHP eligible) of the road (48FR415-2 and 48FR415-4) are located north of the Crooks Gap area, within 0.25 miles of the Project Area. These segments exhibit good structural integrity and for the most part are free of direct modern disturbance (Larson, 2010). Other segments nearby are non-contributing. The Project Area is visible from both contributing segments, but the

BLM determined that setting is no longer an aspect of the site's integrity due to extensive modern intrusions through Crooks Gap (e.g., roads, pipelines, power lines, and mines).

The Crooks Gap Stage Station (48FR1435), also eligible for NRHP listing, is on the west bank of Crooks Creek about 0.5 miles west of the Project Area. Similar to the contributing segments described above, setting is no longer an aspect of the site's integrity due to modern intrusions in the area.

Five segments of the Oregon Trail's southern "Military Route" (48FR736) are located approximately 8 miles north of the Project Area. The Oregon Trail in Wyoming is a NRHP eligible property.

3.4.2 Paleontological Resources

Paleontological resources include any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of the life on earth. The BLM manages paleontological resources for their scientific, educational, and recreational values in compliance with the FLPMA, the NEPA, and the Paleontological Resources Preservation Act (PRPA) of 2009. The PRPA affirms the authority for many policies BLM already had in place to manage paleontologic resources, such as issuing permits for collecting paleontologic resources, curation of resources, and the need for confidentiality of locality data. The PRPA law also defines prohibited acts, such as damaging or defacing resources, and establishes both criminal and civil penalties for those acts.

Stratigraphic rex, LLC (SR) conducted a pedestrian paleontological survey at the Sheep Mountain Mine on more than 4,000 acres of BLM, state, and private land (Connely, 2011). SR also completed a literature search to determine known existing paleontologic resource locations in the area, and examined aerial photographs to identify exposed outcrops prior to field work. The literature review did not locate fossil remains in the area.

The survey area contains five major stratigraphic units, including alluvial and colluvial deposits, Crooks Gap Conglomerate, Tertiary Battle Spring Formation (lower and upper members), Fort Union Formation, and Cody Shale (see Section 3.2.2, Geologic Resources). The Project Area has approximately 439 acres of disturbed surface from previous mining activity, and about 892 acres of reclaimed land. Unaltered areas are covered with native vegetation. The majority of the area contains outcrops of the Battle Spring Formation and Crooks Gap Conglomerate. These high-energy sedimentary formations are not particularly conducive to preserving vertebrate or significant invertebrate and plant fossils. Outcrop inspection did not reveal any macro fossil evidence.

The Fort Union and Cody Shale formations are known to host vertebrate fossil remains; however, these finds tend to be sporadic and with low concentration. The Fort Union Formation and Cody Shale are located in the northeast portion of the Project Area. Inspection of this area did not reveal any fossil evidence. The Fort Union Formation has yielded vertebrate fossils in very high concentrations elsewhere in the state (southwestern corner).

The five major formations within the Project Area are Class 3 in the Potential Fossil Yield Classification (PFYC). Formations of Class 3 potential are fossiliferous units where fossil content varies broadly in significance and abundance; which triggered the above described surveys. The Quaternary sediments mapped within the Project Area are PFYC Class 2 or low potential.

3.4.3 Tribal and Native American Religious Concerns

On September 5, 2012, the BLM and tribal representatives visited the Sheep Mountain Project Area. The purpose of the tour was to show tribal representatives the Project Area and elicit comments about the Project and sites of religious or cultural significance that may be in the area. A total of six tribes were contacted via letter, email, and phone calls to see if they wanted to send representatives to the field tour. Of the six tribes, two sent representatives to participate in the September 5, 2012 field tour.

No known archaeological sites were located in the Project Area from past surveying, so none were visited during the field tour, but the field tour looked at two nearby sites: the Crooks Gap Stage Station and an intact segment of the Rawlins to Fort Washakie Road. No tribal or Native American religious concerns were identified during tribal consultation.

3.4.4 Socioeconomics

The Sheep Mountain Project Area is located in southeastern Fremont County, approximately 60 miles southeast of Lander, 62 miles southeast of Riverton, 65 miles northwest of Rawlins, and 105 miles southwest of Casper. The area is characterized by livestock grazing and extensive uranium development that occurred in the 1970s, 1980s, and part of the 1990s. Several oil and gas fields are also present in the area (see Map 3.2-6). The closest communities are Jeffrey City (8 miles) and Bairoil (16 miles), which have limited services and amenities. Impacts to Jeffrey City could occur, depending on temporary or permanent housing that could be potentially developed in the area. Lander and Riverton, in Fremont County, and Rawlins, in Carbon County, are the larger communities most likely to be affected by the Proposed Action. Therefore, the affected environment for socioeconomic impacts associated with mining and milling in the Project Area includes Fremont and Carbon counties.

Fremont County follows Sweetwater County as Wyoming's second largest county, covering 9,183 square miles. The county's geographic variety highlights its economic diversity. In the western portion of the county, the Wind River Mountains support tourism, with outdoor-based recreation activities centered in Lander and Dubois. The Wind River Indian Reservation, home to approximately 2,500 Shoshone Indians and 5,000 Northern Arapahoe Indians, lies in the central portion of the county (Wind River Visitors Council, 2013). The nearest reservation boundary is approximately 60 miles northwest of the Project Area. Because of the reservation's distance from the Project Area, this document does not describe socioeconomic conditions on the reservation as distinct from those for Fremont County as a whole. Feed crops, particularly alfalfa and sugar beets, are grown in irrigated fields surrounding Riverton. Oil and gas production in the eastern portion of the county largely centers around the towns of Lysite, Shoshone, and Pavilion and makes a substantial contribution to the county's growing mineral development industries. The oil and gas industry contributes by far the largest percentage of revenue to the national, state, and local governments of any industry (BLM, 2011b). Oil and gas activities in the Bairoil and Jeffrey City areas, while smaller than development in other parts of the county, have strong impacts to those communities.

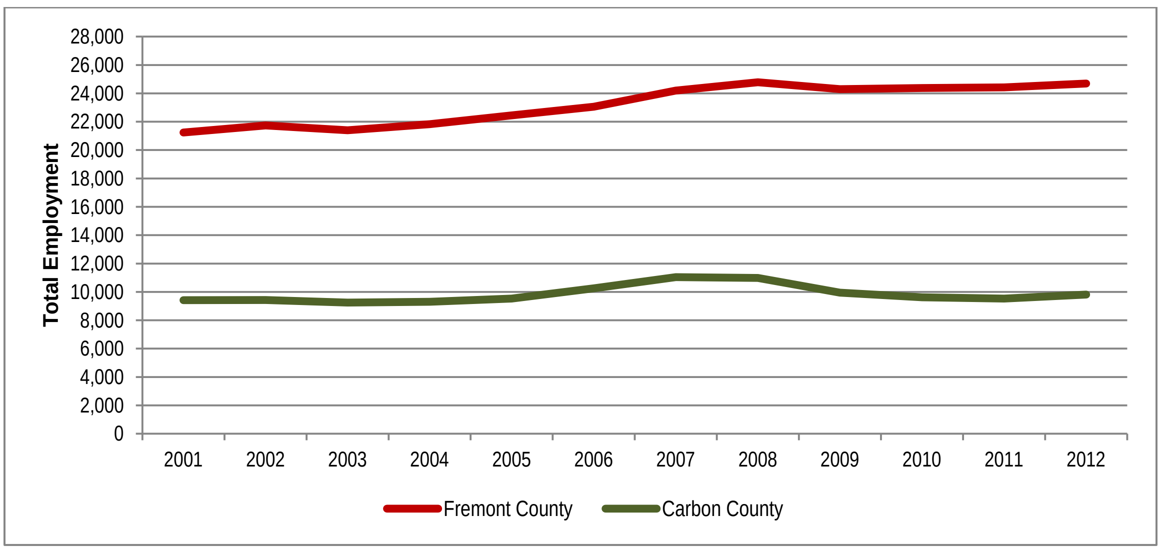
Fremont County ranks second in Wyoming for total uranium production, with over 100 million pounds of uranium produced since mining began in the 1950s. There has been little uranium mining activity in Fremont County since the market for uranium collapsed in the 1980s. The last production at the Sheep Mountain Mine occurred in 1985 (BLM, 2011b). Although several entities are pursuing uranium development opportunities, there was no uranium mining in Fremont County as of early 2014.

With 7,897 square miles, Carbon County is the third largest county in Wyoming. The Project Area is near the county's northwest corner. Development patterns in Carbon County originally followed the Union Pacific railroad tracks, and most of the county's population lives near the Interstate-80 corridor in the central portion of the county. Mineral development includes coal mining near Hanna and oil and gas production in the western and northeastern portions of the county. Medicine Bow National Forest and the North Platte River support tourism and hunting and fishing in southern Carbon County. Rawlins is the county's largest community, the county seat, and the site of the Wyoming State Penitentiary.

3.4.4.1 Economic Conditions

Primary employment sectors include education, health care, accommodations and food services, and retail establishments. Government employment is also prominent in both counties, due in large part to the sizeable tracts of public land (public land covers 86 percent of Fremont County and 61 percent of Carbon County), and the counties' large sizes and dispersed populations.

Employment. Fremont County has a larger employment base than Carbon County. Between 2001 and 2012, total employment in Fremont County ranged from a low of 21,243 jobs in 2001 to a high of 24,782 jobs in 2008, and included 24,688 jobs in 2012 (see Figure 3.4-1). Between 2001 and 2012, total employment in Carbon County ranged from a low of 9,247 jobs in 2003 to a high of 11,036 jobs in 2007, and included 9,808 jobs in 2012 (Bureau of Economic Analysis - BEA, 2014a). Over the past decade, employment in Fremont County has been more stable during national economic downturns than employment in Carbon County. Between 2001 and 2007, employment increased nearly 14 percent in Fremont County and 17 percent in Carbon County. Following the economic recession of 2008, employment in Fremont County increased 2 percent between 2007 and 2012, while employment in Carbon County decreased 11 percent during this period.



[1] **Source: BEA, 2014a.**

Figure 3.4-1
Total Full and Part-Time Employment, Fremont and Carbon Counties, 2001 – 2012[1]

Employment by Industry. The compositions of each county's economy during this period, in terms of covered (wage) employment, which excludes proprietors (self-employed workers) and farm workers, are shown in Tables 3.4-2 and 3.4-3. Education and health services, retail trade, public administration, and accommodations and food services are the largest sources of employment in Fremont County (see Table 3.4-2). Combined, these sectors account for approximately 57 percent of wage employment in the county. Between 2001 and 2012, wage employment in Fremont County increased nearly 17 percent. Nearly all of the job growth occurred before 2008; between 2008 and 2012 the number of wage and salary workers in the county only increased by 2 percent. Between 2001 and 2012, most new jobs were created in the Education and Health Services (702 new jobs), Mining (649 new jobs), and Public

Administration (312 new jobs) sectors. The oil and gas industry accounted for nearly all new jobs in the Mining sector.

Table 3.4-2
Employment by Industry: Fremont County, 2001, 2008 and 2012[1,2]

Industrial Sector	2001		2008		2012	
	Average Annual Employment	Average Annual Wages	Average Annual Employment	Average Annual Wages	Average Annual Employment	Average Annual Wages
Ag., Forestry, Fishing, Hunting	102	$19,046	131	$20,253	143	$23,713
Mining	310	$41,669	822	$68,379	959	$82,018
Utilities	--	--	--	--	91	$61,560
Construction	1,378	$31,788	1,189	$36,134	988	$41,967
Manufacturing	476	$24,453	423	$31,667	235	$37,881
Wholesale Trade	--	--	--	--	384	$40,417
Retail Trade	1,939	$19,163	2,100	$24,520	1,881	$27,321
Transportation & Warehousing	448	$33,306	478	$47,008	431	$45,889
Information	271	$21,709	262	$30,428	208	$35,024
Finance & Insurance	268	$29,819	331	$38,815	323	$43,724
Real Estate, Rental & Leasing	181	$20,332	396	$39,340	362	$48,456
Professional & Technical Services	365	$27,909	484	$51,187	541	$52,691
Mgmt of Companies & Enterprises	--	--	15	$112,454	11	$176,909
Administrative & Waste Services	--	--	185	$34,252	200	$35,675
Education & Health Services[3]	3,788	$24,284	4110	$37,284	4,490	$38,353
Arts, Entertainment, Recreation	91	$10,057	118	$12,803	130	$11,892
Accommodation & Food Services	1,390	$9,582	1,481	$13,108	1,480	$14,858
Other Services	--	--	--	--	483	$30,019
Public Administration[4]	1,422	$26,371	1,685	$37,125	1,734	$44,844
Total Employment by Industry	14,396	$23,899	16,643	$34,864	16,802	$39,086

[1] Source: BLS, 2014a.
[2] Excludes proprietors and farm employment and earnings.
[3] Includes school district employees.
[4] Includes federal, state, and local government employment.

Between 2001 and 2012, wages in Fremont County increased most rapidly in the Real Estate, Rental and Leasing, Professional and Technical Services, and Mining sectors. In 2012, average annual wages in Fremont County varied from highs of $176,909 in Management of Companies and Enterprises and $82,018 in Mining to lows of $14,858 in Accommodations & Food Services and $11,892 in Arts, Entertainment & Recreation (Bureau of Labor Statistics - BLS, 2014a).

Education and health services, public administration, accommodations and food services, and retail trade are also the largest sources of wage employment in Carbon County (see Table 3.4-3). Combined, these sectors account for approximately 59 percent of the county's wage employment. Between 2001 and 2008, wage employment in Carbon County increased 22 percent, due largely to job growth in the Mining and Construction sectors. Many of these jobs have been lost since 2008; wage employment in Carbon County fell nearly 11 percent between 2008 and 2012, for an overall job growth rate of 9 percent between 2001 and 2012.

Between 2001 and 2012, wages in Carbon County increased most rapidly in the Mining and Transportation and Warehousing sectors. In 2012, average annual wages varied from highs of $79,339 in Mining and $63,246 in Utilities to lows of $22,956 in Arts, Entertainment and Recreation and $17,546 in Accommodations and Food Services (BLS, 2014a).

Table 3.4-3
Employment by Industry: Carbon County, 2001, 2008 and 2012[1,2]

Industrial Sector	2001		2008		2011	
	Average Annual Employment	Average Annual Wage	Average Annual Employment	Average Annual Wage	Average Annual Employment	Average Annual Wage
Ag., Forestry, Fishing, Hunting	226	$19,307	--	--	167	$34,707
Mining	164	$42,840	455	$63,733	251	$79,339
Utilities	37	$43,019	57	$49,009	57	$63,246
Construction	401	$28,491	1,102	$64,282	524	$49,595
Manufacturing	490	$42,450	--	--	--	--
Wholesale Trade	126	$34,606	73	$45,085	64	$41,250
Retail Trade	722	$16,767	808	$24,770	685	$27,905
Transportation & Warehousing	178	$28,820	305	$51,500	300	$53,447
Information	75	$19,449	79	$28,833	84	$28,036
Finance & Insurance	111	$30,230	148	$37,014	135	$39,474
Real Estate, Rental & Leasing	69	$11,636	91	$18,598	82	$27,744
Professional & Technical Services	118	$24,149	168	$67,022	152	$69,770
Mgmt of Companies & Enterprises	--	--	18	$46,931	19	$59,947
Administrative & Waste Services	--	--	121	$35,462	116	$32,129
Education & Health Services[3]	1,196	$25,013	1,211	$37,422	1,284	$37,382
Arts, Entertainment, Recreation	87	$19,600	78	$25,835	90	$22,956
Accommodations & Food Services	804	$9,959	961	$14,588	957	$17,546
Other Services	159	$18,719	165	$27,899	139	$26,705
Public Administration[4]	1,043	$32,614	1,158	$41,762	1,136	$45,870
Total Employment by Industry	6,302	$24,823	7,698	$41,243	6,873	$41,550

[1] Source: BLS, 2014a.
[2] Excludes proprietors and farm employment and earnings.
[3] Includes school district employees.
[4] Includes federal, state, and local government employment.

Agriculture. Farming and ranching make notable contributions to employment in Fremont and Carbon counties. Between 2001 and 2012, farming (including ranching) accounted for an average of 11 percent of total employment in Fremont County and an average of 6 percent of total employment in Carbon County (BEA, 2014a). In 2012, farm employment (labor and proprietors) in Fremont County included 2,717 workers, and the average farm income was $7,814. In that year, farming employed 609 workers in Carbon County, and the average farm income was $13,856 (see Table 3.4-4).

In 2012, Fremont County ranked second in the state based on the value of livestock inventories and crop production, and Carbon County ranked sixth (USDA, 2014a). In that year, Fremont County ranches and farms reported total sales of nearly $102.5 million in agricultural products, and ranches and farms in Carbon County reported total agricultural sales of approximately $78.6 million. In both counties, cattle and calves account for the majority of livestock inventories, followed by sheep and lambs. Major crop production in Fremont County includes hay, corn for grain and sileage, dry edible beans, barley, and sugar beets. Crop production in Carbon County consists primarily of hay production (USDA, 2014b).

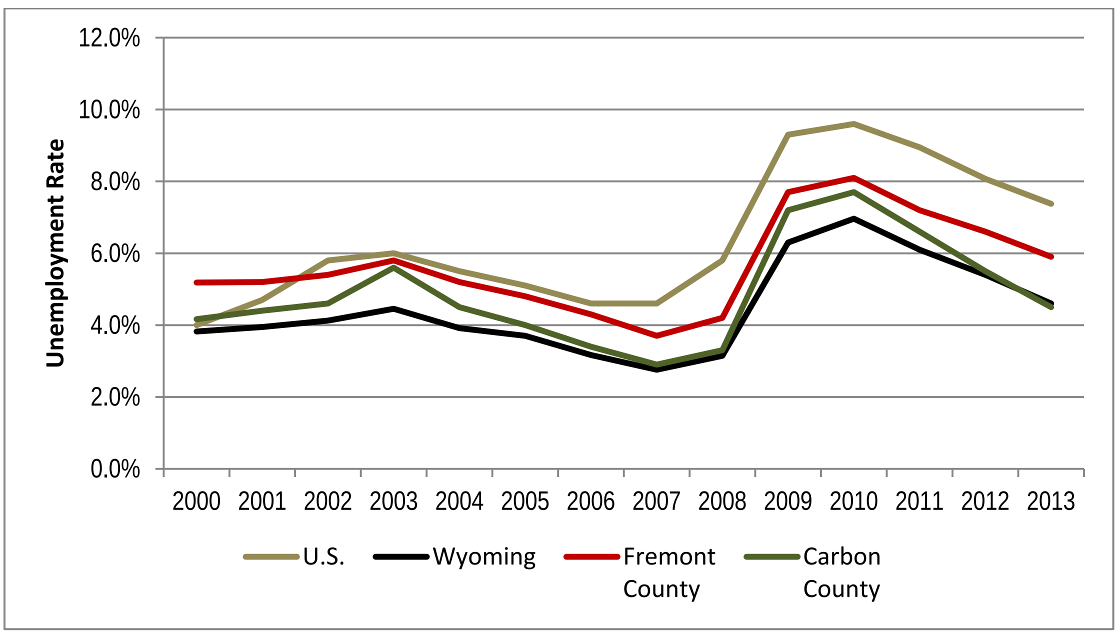
Table 3.4-4 provides an overview of farming trends in Fremont and Carbon counties. Along with the upward trends in employment and market values for agricultural output in Fremont County, farming is becoming more intensive in that county. The portion of Fremont County covered by farmland decreased from nearly 43 percent in 2002 to 29 percent in 2012. Farming in Carbon County is more reliant on livestock production, and the portion of the county covered by farmland remained relatively stable between 2002 (46 percent) and 2012 (47 percent).

Table 3.4-4
Overview of Agriculture in Fremont and Carbon Counties, 2002 and 2012

Economic Measure	Fremont County		Carbon County	
	2002[1]	2012[2]	2002[1]	2012[2]
Total farm employment[3]	2,359	2,717	782	609
Average farm income[3]	$1,756	$7,814	$5,733	$13,856
Number of farms	1,049	1,363	290	319
Land in farms (acres)	2,503,853	1,710,015	2,329,571	2,374,154
Farm land as percent of county area	42.6%	29.1%	46.1%	47.0%
Market value of agricultural products sold	$59,854,000	$102,482,000	$43,142,000	$78,578,000
Livestock	$44,916,000	$51,496,000	$42,094,000	$67,358,000
Crops	$14,938,000	$50,986,000	$1,048,000	$11,219,000
Farm operators with farming as principal operation				
Number of operators	579	749	191	192
Percent of all farm operators	56.8%	55.0%	65.9%	60.2%

[1] USDA, 2002.
[2] USDA, 2014b.
[3] BEA, 2014a.

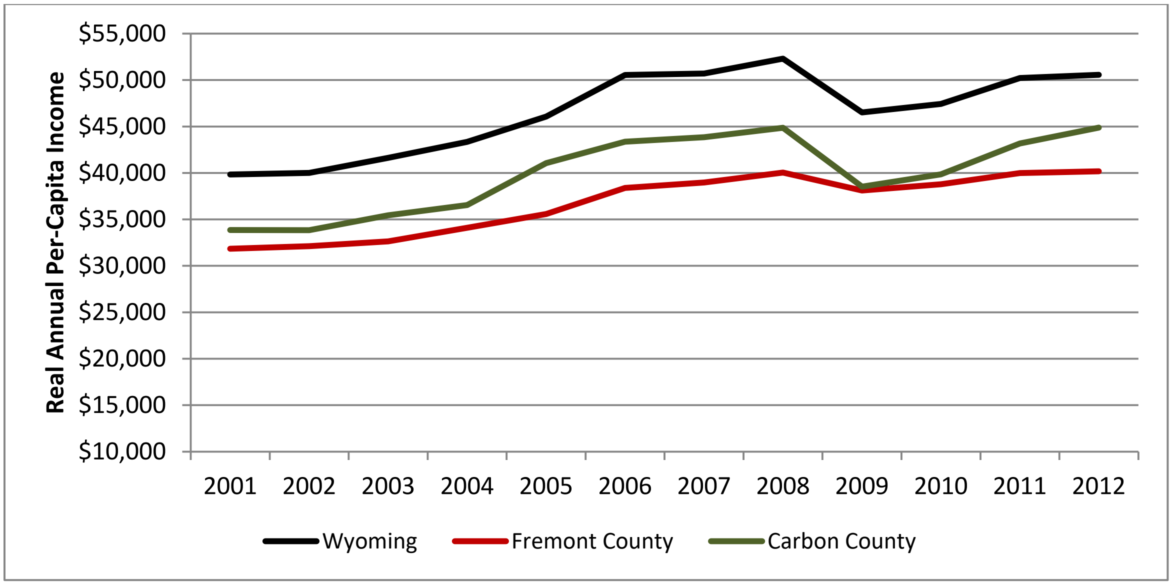
Unemployment Rates. Unemployment rates in Wyoming remained below the national average between 2000 and 2013. During this time, unemployment rates in Fremont County exceeded unemployment rates in Carbon County and statewide unemployment rates (see Figure 3.4-2). Unemployment rates were lowest in 2007, when the unemployment rate was 2.8 percent in Wyoming, 3.7 percent in Fremont County and 2.9 percent in Carbon County. Unemployment rates were highest in 2010, at 7.0 percent across Wyoming, 8.1 percent in Fremont County and 7.7 percent in Carbon County. In 2013, unemployment rates had fallen to 4.6 percent in Wyoming, 5.9 percent in Fremont County, and 4.5 percent in Carbon County (BLS, 2014b).



[1] Source: BLS, 2014b.

Figure 3.4-2
National, State and County Unemployment Rates, 2000 - 2013[1]

Income. A common measure of economic health is per-capita personal income. Due to inflation, the purchasing power of the dollar changes over time, so in order to compare dollar values from one year to another, they need to be converted from nominal (current) dollar values to constant or real, dollar values. Between 2001 and 2012, real per-capita income levels and growth rates were lower in Fremont County than in Carbon County and the state as a whole (see Figure 3.4-3). In 2012, real per-capita income (measured in constant 2012 dollars) averaged $50,567 in Wyoming, $40,177 in Fremont County, and $44,882 in Carbon County (BEA, 2014b). Between 2001 and 2012, real per capita income increased 27 percent in Wyoming, 26 percent in Fremont County, and 33 percent in Carbon County.



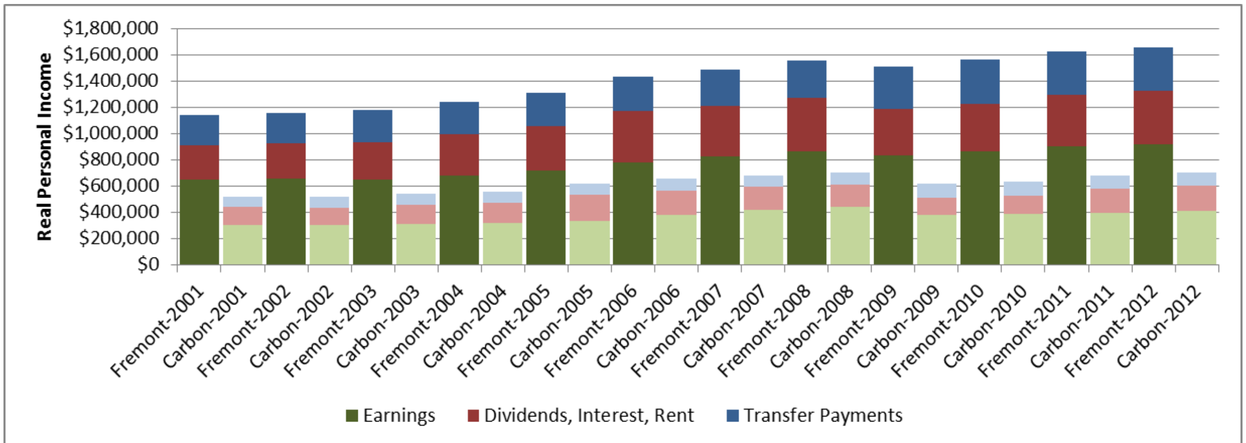
[1] Source: BEA, 2014b.
[2] All dollars expressed in constant 2012 dollars.

Figure 3.4-3
Real Per-Capita Income in Fremont County, Carbon County and Wyoming, 2001 2012[1,2]

Total personal income within a county includes residents' net earnings and non-earned income from dividends, interest and rent, and transfer payments. Net earnings consist of total earnings less contributions for government social insurance. Income from dividends, interest, and rent is also referred to as "investment income." Transfer payments include retirement, disability insurance benefits, medical payments, income maintenance benefits, unemployment insurance benefits, and veterans' benefits.

Total personal income in Fremont and Carbon counties is heavily dependent on earnings (see Figure 3.4-4). Between 2001 and 2012, net earnings comprised an average of 55 percent of personal income in Fremont County and an average of 59 percent in Carbon County. During this time, investment income contributed an average of 25 percent to personal income in Fremont County and an average of 26 percent in Carbon County. Transfer receipts accounted for an average of 20 percent of personal income in Fremont County and 15 percent in Carbon County.

Between 2001 and 2012, all components of personal income increased more rapidly in Fremont County than in Carbon County. After adjusting for inflation, in Fremont County net earnings increased 42 percent, investment income increased 54 percent, and transfer receipts increased 45 percent. In Carbon County, inflation-adjusted earnings increased 34 percent, investment income increased 46 percent, and transfer payments increased 31 percent (BEA, 2014b).



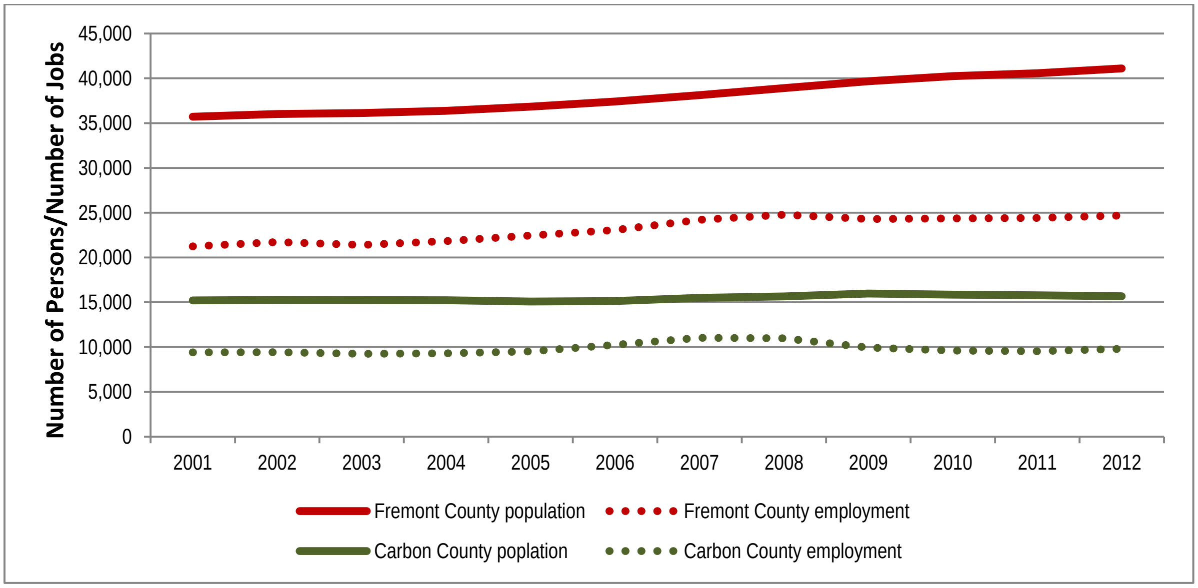
[1] Source: BEA, 2014b.
[2] All dollars expressed in constant 2012 dollars.

Figure 3.4-4
Components of Personal Income, Fremont and Carbon Counties, 2001 – 2012[1,2]

Commuting Patterns. The Census Bureau's American Community Survey (ACS) collects information on county commuting patterns. Between 2008 and 2012, 95 percent of Fremont County's workforce worked in Fremont County and 3.4 percent of the county's workforce worked outside the county. During this time, 86 percent of Carbon County's workforce worked in Carbon County, and 12 percent worked outside the county (Census Bureau, 2013a). The Wyoming Department of Workforce Services (WDWS) analyzes inter-county commuting patterns. At the time this report was written, inter-county commuting data were available between 2004 and 2011. Fremont County was a net exporter of labor between 2004 and 2006 (that is, more residents of Fremont County worked outside the county than residents of other counties worked in Fremont County), and became a net importer of labor in 2007. Worker commuting trends in Carbon County have tended to be opposite those in Fremont County; Carbon County was a net importer of labor between 2004 and mid-2007, and has generally been a net labor exporter since that time (WDWS, 2010 and 2012).

3.4.4.2 Population

Population trends typically follow employment trends. Figure 3.4-5 shows the relationship between employment and population in Fremont and Carbon counties between 2001 and 2012 and illustrates that population and employment have followed similar trends in each county. Between 2001 and 2012, employment in Fremont County increased 16 percent and the population increased 15 percent. In Carbon County, employment and population increased more modestly, at 4 percent, and 3 percent, respectively.



[1] **Sources: WDAI, 2013a, BEA, 2014a.**

Figure 3.4-5
Employment and Population, Fremont and Carbon Counties, 2001 – 2012[1,]

Population Trends. In 2010, Fremont County had 40,123 residents, and Carbon County had 15,885. Since 1990, population growth in Fremont and Carbon counties has lagged that of the state as a whole. Between 1990 and 2000, Wyoming's population increased by approximately 9 percent, while Fremont County's population increased by 6 percent and Carbon's County's population decreased 6 percent (see Table 3.4-5). Between 2000 and 2010, many of Wyoming's counties, especially those with active mineral development industries, experienced high population growth. Population gains during the decade averaged 14 percent across Wyoming, 12 percent in Fremont County, and 2 percent in Carbon County (Wyoming Department of Administration and Information – WDAI, 2013a). These statistics do not reflect increases in temporary populations associated with the region's surge in natural gas development since 2000.

Table 3.4-5
Population Estimates, Forecasts and Grow Rates[1]

	Population Estimates						Population Growth Rates (Percent)			
Place	**1990**	**2000**	**2010**	**2013**	**2020**	**2030**	**1990-2000**	**2000-2010**	**2010-2020**	**2020-2030**
Wyoming	453,589	493,782	563,626	580,670	622,360	668,830	8.9	14.1	10.4	7.5
Fremont County	33,662	35,804	40,123	41,460	44,360	47,120	6.4	12.1	10.6	6.2
Lander	7,023	6,867	7,487	7,736	8,278	8,793	-2.2	9.0	10.6[2]	6.2[2]
Riverton	9,202	9,310	10,615	10,969	11,736	12,466	1.2	14.0	10.6[2]	6.2[2]
Jeffrey City	253	106	58	NR[3]	NR[3]	NR[3]	-58.1	-45.3	--	--
Carbon County	16,659	15,639	15,885	15,940	16,380	16,270	-6.1	1.6	3.1	-0.7
Rawlins	9,380	9,006	9,259	9,291	9,548	9,483	-4.0	2.8	3.1[2]	-0.7[2]

[1] Source: WDAI, 2013a.
[2] Projected local growth rates are equal to WDAI's projected growth rate for the county in which the town is located.
[3] NR = Not Reported (not estimated by WDAI).

According to the Census Bureau's decennial censuses, Riverton's population increased approximately 1 percent (108 people) during the 1990s, while Lander's population fell 2 percent (156 people) (Census Bureau, 2001). Both cities had strong population growth during the 2000s: Riverton's population increased 14 percent (1,305 people) and Lander's population increased 9 percent (620 people) between 2000 and 2010 (Census Bureau, 2011). These statistics are likely to underestimate Riverton and Lander's growth because much of the new development has been outside city limits. County and city permits associated with new residential construction indicate that a sizeable portion of these communities' growth has occurred in unincorporated areas. Outside city limits, new residential development in Fremont County requires a septic permit. Between 2000 and 2010, Fremont County issued 434 septic permits for new residential construction within a 10-mile radius of Riverton, and 381 permits within 10 miles of Lander (Lopez, 2012). During this time, building permits were issued for 346 new residential units inside Riverton city limits, and 167 building permits were issued within Lander city limits (WDAI, 2013b).

In Carbon County, Rawlins' population fell 4 percent during the 1990s (374 people) and increased 3 percent (253 people) during the 2000s. The populations of communities near the Project Area have fallen dramatically over the past two decades. The unincorporated community of Jeffrey City lost 77 percent of its population (196 people) between 1990 and 2010. Although it is not included in Table 3.4-2, the Town of Bairoil, in Sweetwater County, lost 55 percent of its population (125 people) between 1990 and 2010. In 2010, Jeffrey City had 58 residents and Bairoil had 103 (WDAI, 2013a).

Projecting long-term population growth is difficult, especially in areas such as Wyoming, where population trends are influenced by trends in mineral development, which are, in turn, affected by fluctuating commodity prices. Some of the projects that may affect future population trends in Fremont and Carbon counties are discussed in Chapter 5, Section 5.4.15. The WDAI projects that, between 2010 and 2030, population growth rates in Fremont County will be comparable to statewide growth rates and that growth rates in Carbon County will continue to be lower. Between 2010 and 2020, Fremont County is projected to gain 4,237 residents and Carbon County is projected to gain 495 residents (WDAI, 2013a).

Population by Age. The age distribution of Carbon County's population is broadly comparable to that of the state as a whole. Fremont County has slightly higher portions of non-working age populations (under 20 and over 64 years of age) than the state and Carbon County (see Table 3.4-6). In 2012, persons under 20 years of age accounted for 26 percent of the state's population, 28 percent of Fremont County's population, and 25 percent of Carbon County's population. Persons between the ages of 20 and 64 years of age, who comprise the majority of the labor force, accounted for 61 percent of the state's population, 57 percent of Fremont County's population, and 62 percent of Carbon County's population. Persons aged 65 and older, who are at or nearing retirement, accounted for 13 percent of the state's population, 15 percent of Fremont County's population, and 14 percent of Carbon County's population (WDAI, 2013a).

Table 3.4-6
Wyoming, Fremont and Carbon County Populations by Age, 2012[1]

Age Range	Wyoming		Fremont County		Carbon County	
	Number	Percent	Number	Percent	Number	Percent
Under 10 Years	77,487	13.4%	6,093	14.8%	2,030	13.0%
10 to 19 Years	73,556	12.8%	5,249	12.8%	1,879	12.0%
20 to 34 Years	123,690	21.5%	7,763	18.9%	3,211	20.5%
35 to 49 Years	104,062	18.1%	6,828	16.6%	2,906	18.5%
50 to 64 Years	122,109	21.2%	8,908	21.7%	3,528	22.5%
65 Years and Older	75,508	13.1%	6,269	15.2%	2,112	13.5%
Total	576,412	100.0%	41,110	100.0%	15,666	100.0%

[1] Source: WDAI, 2013a.

3.4.4.3 Boom and Bust Characteristics

Jeffrey City is an oft-cited example of the “boom and bust” cycle that many extractive industries can experience. In 1957, Western Nuclear Corporation opened the Split Rock Uranium Mill near Jeffrey City. The town grew rapidly during the uranium boom of the late 1950s, driven by growth in the U.S. nuclear defense program and a restricted domestic source of uranium. The next boom period occurred in the early 1970s. It is difficult to establish an accurate population in a boom town. Although the Census Bureau reported Jeffrey City’s population to be 1,276 in 1980, this is below the combined total of mine employees and local school enrollments at that time. Jeffrey City’s population is widely considered to have approximated 4,500 in 1979 (Amundson, 1995). However, after the Three Mile Island incident in 1979 and the growing availability of alternative sources of nuclear power plant fuel material, uranium prices plummeted, and Jeffrey City lost 95 percent of its population within three years. Jeffrey City had 253 residents in 1990, 106 residents in 2000, and 58 residents in 2010 (WDAI, 2013a).

3.4.4.4 Housing

Long Term Housing. Most of the housing stock in Fremont and Carbon counties consists of owner-occupied single-family homes. Between 2008 and 2012, single-family homes accounted for 70 percent of the housing units in Fremont County and 72 percent of the housing units in Carbon County. Mobile homes accounted for 17 percent and 16 percent of the housing units in Fremont and Carbon counties, respectively. Owners occupied 71 percent of the occupied housing units in Fremont County and 73 percent of the occupied housing units in Carbon County. Most rental units are located in urban areas; between 2008 and 2012 renters occupied approximately 36 percent of the occupied housing units in Lander, 39 percent of the occupied housing units in Riverton, and 31 percent of the occupied housing units in Rawlins (Census Bureau, 2013a). Table 3.4-7 shows the characteristics of the housing supply in communities near the Project Area. These Census estimates are likely to underestimate the number of temporarily-sited mobile homes and recreational vehicles, especially in rural areas.

Table 3.4-7
Housing Characteristics in Potentially Affected Communities Near the Project Area, 2007-2011[1]

Housing Characteristic	Fremont County	Jeffrey City	Lander	Riverton	Carbon County	Rawlins
Housing Units	17,710	56	3,201	4,867	8,580	3,828
Percent of Single-Family Homes (Detached)	69.9%	0.0%	69.3%	62.3%	71.5%	63.5%
Percent of Multifamily Homes	13.1%	100.0%	20.1%	25.3%	12.4%	23.3%
Percent of Mobile Homes	17.0%	0.0%	10.7%	12.2%	15.9%	13.0%
Percent of Boat, Van, RV, etc.	0.1%	0.0%	0.0%	0.2%	0.2%	0.2%
Occupied Housing Units	15.538	0	2,971	4,439	6,044	3,150
Percent Owner Occupied	71.4%	0.0%	63.9%	60.8%	73.2%	69.3%
Percent Renter-Occupied	28.6%	0.0%	36.1%	39.2%	26.8%	30.7%

[1] Source: Census Bureau, 2013a.

Although limited data on housing quality are available, the ACS reports data related to incomplete plumbing and kitchen facilities, which are indicators of potential housing problems. According to the 2012 ACS, 3.3 percent of all housing units in Fremont County and 8.4 percent of all housing units in Carbon County lacked complete kitchen facilities; a classification that includes a kitchen that is missing either a sink with piped hot and cold water, a range or cook top and oven, or a refrigerator. This compared to 2.9 percent of households statewide without complete kitchen facilities. In addition, 2.7 percent of all housing units in Fremont County and 9.1 percent of all housing units in Carbon County lacked complete plumbing facilities, a classification that includes units that lack either piped hot and cold water, a flush toilet, or a bathtub or shower. This compared to 2.3 percent of statewide households lacking complete plumbing facilities (Census Bureau, 2013a).

The Wyoming Rental Vacancy Survey, which is conducted semi-annually by the Wyoming Housing Database Partnership (WHDP), provides additional information about housing quality. The December 2013 survey suggests that the majority of rental housing in Fremont and Carbon counties is in adequate condition. According to the December 2013 survey, of the surveyed renter households in Fremont County who provided a response on the condition of their rental unit, 15 percent said their unit was in fair condition, 9 percent said their unit was in average condition, 50 percent said their unit was in good condition, and 27 percent said their unit was in excellent condition. Among surveyed Carbon County renter households who ranked their condition of their homes, 17 percent said their unit was in average condition, 65 percent said their unit was in good condition, and 18 percent said their unit was in excellent condition (WHDP, 2014a).

Since 2001, Fremont County has had a tighter rental market than Carbon County. Approximately 25 percent of the rental units in Fremont County are in Lander, and 33 percent are in Riverton. Between 2004 and 2012, average vacancy rates in Fremont County tended to remain near or below the 5 percent vacancy rate that indicates a balanced rental market, and rent levels generally increased (see Table 3.4-8). Rental units tend to be in multifamily dwellings, and between 2000 and 2010, multifamily units accounted for approximately 26 percent of the building permits issued by Fremont County, 30 percent of the building permits issued by the City of Lander, and 35 percent of the building permits issued by the City of Riverton (WDAI, 2013b). This indicates that the county’s housing market has responded to the demand for rental units.

Nearly 60 percent of Carbon County’s rental units are in Rawlins. With the exception of the period between the fourth quarter 2005 and 2nd quarter 2008, and, more recently, between the second and fourth quarters of 2012, average vacancy rates remained above 5 percent. Average rent levels tended to increase between 2002 and 2008, and then declined through early 2012 (WHDP, 2014a). Stimulated by expanding natural gas development in the Continental Divide area near Wamsutter, the average rent level in Carbon County has increased since the fourth quarter of 2011. Between 2000 and 2011, less than 2 percent of the building permits issued by Carbon County and none of the building permits issued by the City of Rawlins were for multi-family units (WDAI, 2013b).

Table 3.4-8
Vacancy Rates and Rents in Fremont and Carbon Counties, Second Quarter 2001 – Fourth Quarter 2013[1]

	Fremont County		Carbon County	
Quarter/ Year	Average Vacancy Rate	Average Rent[2]	Average Vacancy Rate	Average Rent[2]
2Q-2001	6.6%	$422	5.7%	$400
4Q-2001	5.4%	$416	16.1%	$377
2Q-2002	16.1%	$442	15.0%	$391
4Q-2002	8.5%	$424	9.6%	$387
2Q-2003	3.5%	$434	11.9%	$392
4Q-2003	5.7%	$452	11.0%	$415
2Q-2004	4.6%	$455	8.9%	$433
4Q-2004	2.9%	$469	14.5%	$442
2Q-2005	1.2%	$475	7.6%	$483
4Q-2005	1.9%	$484	3.7%	$470
2Q-2006	2.5%	$500	2.4%	$603
4Q-2006	1.4%	$533	1.0%	$666
2Q-2007	0.8%	$554	0.8%	$705
4Q-2007	1.4%	$564	1.0%	$713
2Q-2008	1.6%	$592	1.6%	$766
4Q-2008	1.9%	$647	10.8%	$788
2Q-2009	5.5%	$649	22.1%	$758
4Q-2009	5.0%	$674	16.0%	$746
2Q-2010	3.6%	$674	9.8%	$711
4Q-2010	3.2%	$705	14.1%	$732
2Q-2011	2.4%	$705	7.2%	$720
4Q-2011	3.8%	$716	6.7%	$746
2Q-2012	2.1%	$719	5.0%	$722
4Q-2012	2.9%	$730	3.1%	$808[3]
2Q-2013	2.8%	$736	6.4%	$829
4Q-2013	7.5%	NR[3]	11.4%	NR[3]

[1] WHDP, 2014a.
[2] Average rent for apartments, houses, and mobile homes.
[3] NR = Not Reported.

The cost of home ownership tends to be higher in Fremont County than Carbon County. Within Fremont County, housing costs tend to be higher in Lander than in Riverton. Between 2000 and 2012, the average residential sales price increased 96 percent in Fremont County and 114 percent in Carbon County (see Table 3.4-9). The U.S. Department of Housing and Urban Development (HUD) defines housing to be affordable if no more than 30 percent of a household's gross monthly income is spent on total housing costs (HUD, 2006). Assuming a 5 percent interest rate on a standard 30 year fixed loan, a 5 percent down payment, and the inclusion of property taxes and private mortgage insurance in monthly housing costs, based on HUD's housing affordability guidelines, an annual income of $27,425 would have been required to purchase the average priced house in Fremont County ($111,638) in 2001. This income level is above the county's average 2001 wage level of $23,899 and below the median household income of $32,503 and average 2001 mining sector wages of $41,669. In 2012, an annual income of $49,574 would have been required to purchase the average priced house in Fremont County ($201,800). In that year, the county's average wage level was $39,086, median household income was $47,906, and average mining sector wages were $82,018 (BLS, 2014a; Census Bureau, 2001; Census Bureau, 2013b).

Housing costs in Carbon County have coincided more closely with HUD's housing affordability guidelines. In 2001, an annual income of $20,924 was needed to purchase the average priced house in Carbon County ($85,176). This income level is below the county's 2001 average wage level of $24,823, median household income of $35,600, and average mining sector wages of $42,840. In 2012, an annual income of $37,658 would have been required to purchase the average priced house in Carbon County ($153,293). This income level is below the county's average 2012 wage level of $41,550, the median household income of $53,780 and average mining sector wages of $79,339.

Table 3.4-9
Average Residential Sales Prices in Fremont and Carbon Counties, 2000 – 2012[1]

Year	Fremont County	Carbon County	Year	Fremont County	Carbon County
2000	$102,957	$71,526	2007	$185,918	$148,813
2001	$111,638	$85,176	2008	$197,173	$151,093
2002	$113,828	$78,436	2009	$194,633	$155,259
2003	$125,767	$88,123	2010	$196,283	$150,244
2004	$132,245	$94,377	2011	$182,541	$137,302
2005	$140,975	$96,200	2012	$201,800	$153.293
2006	$163,775	$118,335			
[1] Source: WHDP, 2014a.					

Short Term Housing. Several motels and recreational vehicle (RV) parks provide short-term housing accommodations in communities near the Project Area. An internet search of lodging accommodations found approximately 1,822 motel rooms and 615 RV sites in Lander, Riverton, Jeffrey City, and Rawlins (see Table 3.4-10). Because these estimates are based on lodging and RV facilities with an on-line presence, they are likely to underestimate the number of short-term housing accommodations near the Project Area because they do not include smaller establishments and privately-let facilities that do not advertise on the internet.

Table 3.4-10
Short-Term Housing Accommodations Near the Project Area

Area	Hotels/Motels[1]		RV Campgrounds[2]	
	Number of Establishments	Number of Rooms	Number of Campgrounds	Number of Sites
Fremont County				
Lander	6	281	8	257
Riverton	12	809	2	45
Jeffrey City	--	--	1	18
Carbon County				
Rawlins	10	732	4	295
Study Area Total	**28**	**1,822**	**15**	**615**
[1] TripAdvisor.com, 2014.				

Future Housing Demand. The WHDP prepares annual forecasts of the demand for future housing under three forecasting scenarios: a moderate growth scenario, a strong growth scenario, and a very strong growth scenario. The scenarios vary in their assumptions concerning population and income growth and increasing rates of resource extraction (which exert a strong influence on population growth and distribution in Wyoming). The WHDP's housing need predictions suggest how housing markets in Wyoming counties are likely to behave in the long-term if consumers' future housing choices are similar to past trends.

Assuming that the Proposed Action becomes operational in late 2015, this assessment focuses on the WHDP's projected housing demand in the 2015 – 2020 timeframe. Over this period, the WHDP projects that Fremont County will require housing to accommodate an additional 654 to 867 households and that Carbon County will require housing to accommodate an additional 192 households (see Table 3.4-11). Within the study area, Riverton is expected to have the highest household growth and resultant need for housing, and Rawlins is expected to have the lowest. The WHDP projects that, between 2015 and 2020, Riverton will require housing to accommodate an additional 182 to 205 households, that Lander will require housing to accommodate an additional 136 to 152 households, and that Rawlins will require housing to accommodate an additional 103 households. Owner-occupied households account for the majority of projected household growth in all jurisdictions (WHDP, 2014b).

Table 3.4-11
Projected Household Growth in Fremont and Carbon Counties, Lander, Riverton and Rawlins, 2015 – 2020[1]

WHDP Growth Scenario	Fremont County	Lander	Riverton	Carbon County	Rawlins
Moderate Growth Scenario					
Total Households	654	136	182	192	103
Homeowner Households	476	91	123	142	73
Renter Households	177	45	59	49	30
Strong Growth Scenario					
Total Households	762	144	194	192	103
Homeowner Households	547	95	129	141	73
Renter Households	215	49	65	51	32
Very Strong Growth Scenario					
Total Households	867	152	205	192	103
Homeowner Households	612	98	134	141	73
Renter Households	255	54	71	51	32

[1] Source: WHDP, 2014b.

3.4.4.5 Community Services and Public Infrastructure

This section describes the community services, including schools, health care providers, law enforcement agencies, and emergency responders, that cover the Project Area and would potentially be affected by the Proposed Action, including relocating workers.

Schools. The Project Area is located in Fremont School District #1. The district has four elementary schools, one junior high school and one high school. With the exception of the Jeffrey City Elementary School (grades K-6), all schools in the district are located in Lander. Jeffrey City Elementary is a one-room school in which enrollments ranged from 2 to 13 students between 2001 and 2013 (Wyoming Department of Education, 2014). During this time, district-wide enrollment fell 12.6 percent. In 2012, the district had an overall student/teacher ratio of 10.4, which was below the statewide average of 10.8. Lander Christian Academy, a private school for grades K-8; Sunrise School, a public school (grades 1-12) serving special needs students, and Pathfinder Alternative High School are also located in Lander.

Fremont School District #25 is the largest district in the county, with four elementary schools, one middle school and one high school, all located in Riverton. District-wide enrollments increased 6 percent between 2001 and 2013 (see Table 3.4-12). In 2012, the district had an overall student/teacher ratio of 11.7.

Table 3.4-12
School District-Wide Enrollment, 2001 – 2012[1]

Year	Fremont SD 1		Fremont SD 25		Carbon SD 1	
	Student Enrollments	Student/ Teacher Ratio[2]	Student Enrollments	Student/ Teacher Ratio[2]	Student Enrollments	Student/ Teacher Ratio[2]
2001	1,933	11.9	2,484	11.2	1,923	12.0
2002	1,877	12.5	2,471	11.5	1,778	12.2
2003	1,855	12.0	2,425	12.6	1,728	11.2
2004	1,789	11.9	2,423	12.2	1,664	11.0
2005	1,745	11.7	2,422	11.9	1,727	11.1
2006	1,762	11.0	2,473	11.8	1,753	10.0
2007	1,734	10.9	2,355	11.0	1,815	10.4
2008	1,671	10.4	2,454	11.6	1,787	9.7
2009	1,670	10.3	2,465	11.5	1,803	9.7
2010	1,707	10.6	2,474	11.3	1,822	9.6
2011	1,710	10.0	2,588	11.5	1,814	9.6
2012	1,672	10.4	2,582	11.7	1,866	10.5
2013	1.689	NR[3]	2,642	NR[3]	1,876	NR[3]

[1] Source: Wyoming Department of Education, 2014.
[2] Based on the number of certified teachers and instructional aides within each school district.
[3] NR = Not Reported.

Rawlins and Bairoil are in Carbon School District #1. There are three elementary schools, one middle school, one high school, and one cooperative high school in Rawlins. The Town of Bairoil has a one-room elementary school (grades K-5) in which enrollments ranged between four and ten students between 2001 and 2013. The Bairoil Elementary School closed in November 2013 and its students are currently bussed to Sinclair Elementary School, approximately 48 miles from Bairoil, in Carbon County (Casper Star Tribune, 2014). Between 2001 and 2013, district-wide enrollments fell 2 percent. In 2012, the district had an overall student/teacher ratio of 10.5 (Wyoming Department of Education, 2014).

Central Wyoming College is a two-year community college located in Riverton, with a satellite site in Lander. In Rawlins, the Carbon County Higher Education Center provides adult education, vocational and industry training, and college credit courses through Western Wyoming Community College and the University of Wyoming.

Medical Services. Physicians and other medical practitioners in Lander, Riverton, and Rawlins provide medical services in the communities potentially affected by the Proposed Action. In addition to family and specialized medical services, the Lander Medical Clinic and Cedars Health Urgent Care clinics in Riverton and Rawlins provide emergency and urgent care services.

There are two hospitals in Fremont County. The largest, Lander Regional Hospital, is an 89-bed acute care facility whose services include surgery, laboratory, radiology, diagnostic imaging, physical and occupational therapy, respiratory therapy, and cardiac rehabilitation. The hospital's 24-hour emergency department is a state designated trauma facility. Riverton Memorial Hospital is a 70-bed acute care facility with services including 24-hour emergency and physician services, surgery, intensive care, diagnostic imaging, cardiopulmonary services, obstetrics, and laboratory services. Both hospitals arrange life flight services to hospitals in Casper, Billings, Salt Lake, and Denver.

In Rawlins, Memorial Hospital of Carbon County is a 35-bed acute care and critical access facility that offers medical, surgical, intensive care, and obstetrics inpatient services, and several outpatient services. Its emergency services include 24-hour emergency and physician services, full-time ambulance service, and life flight services.

Fremont County provides ambulance and emergency medical services across the county, including the Wind River Indian Reservation. Response calls by Fremont County Ambulance are dispatched out of Riverton and Lander. In July 2013, Fremont County Ambulance stationed an ambulance in Jeffrey City (County10, 2013). The ambulance is staffed by a part-time emergency medical technician (EMT) who lives in Jeffrey City and local volunteers, many of whom will have first responder certification. Local staffing levels and qualifications were not available at the time this report was written.

Public Safety and Emergency Services. The Fremont County Sheriff's Office provides first-call police services in the Project Area. The Sheriff's Office is a public safety answering point that dispatches 911 calls across the county, including the Wind River Indian Reservation. The Sheriff's Office has approximately 125 employees located across the county and a 200-bed detention center in Lander that typically operates near 75 percent capacity. There is one Sheriff's Deputy located in Jeffrey City.

Local police departments provide law enforcement services within their jurisdictions. In 2011, the Lander Police Department had 20 employees, including 19 officers. The Riverton Police Department had 39 employees, including 28 officers and 11 support personnel. The Rawlins Police Department had 29 employees, including 19 officers and 10 support personnel. The Carbon County Sheriff's Office, which has jurisdiction between Rawlins and the Carbon County border leading into Fremont County, had 28 employees, including 18 officers and 10 support personnel (Wyoming Attorney General, 2005-2011).

Table 3.4-13 shows the number of arrests reported by law enforcement agencies between 2006 and 2012. During this time, index offense arrests increased for all agencies except the Rawlins Police Department. Drug abuse violations increased for all police departments and decreased for the Fremont and Carbon county sheriff's offices. Arrests for other offenses increased in the Riverton and Lander police departments and decreased for the Rawlins Police Department and both sheriff's offices. Overall, the number of arrests decreased 38 percent for the Fremont County Sheriff's Office, increased 33 percent for the Lander Police Department, and increased 24 percent for the Riverton Police Department. In Carbon County, the number of total arrests decreased 20 percent for the Sheriff's Office and decreased 57 percent for the Rawlins Police Department (Wyoming Attorney General, 2005 – 2011). Larceny-theft accounts for the majority of index crimes in all jurisdictions, and driving under the influence, drunkenness, liquor law violations, and other assaults account for the majority of other offenses (Stanford, 2014).

The Jeffrey City Volunteer Fire Department (JCVFD) provides first-call emergency services in the Project Area with 11 volunteer firefighters. The JCVFD has a fire station in Jeffrey City, a garage and meeting space in the Sweetwater Station, three pumpers, two brush trucks, a 2,500 gallon tanker, a rescue unit, a ladder truck, and a mobile response unit (Darnell, 2012).

The Lander Volunteer Fire Department (LVFD) serves the City of Lander and upon request, provides assistance to other fire departments in the county. The LVFD has one station with 34 volunteer firefighters, including first-response medical service providers, three structure engines, a ladder truck, a light rescue truck, and a wild-land brush unit. The LVFD responds to approximately 300 calls a year, including first-response and fire calls (Hudson, 2012).

The Riverton Volunteer Fire Department (RVFD) serves the City of Riverton and a 10 mile radius around the city. The RVFD has three fire stations and 39 firemen, three of whom are emergency medical technicians, four fire trucks, and four water tenders. The RVFD responds to approximately 300 calls a year, including hazardous materials emergencies (Walters, 2012).

The Rawlins Fire Department has a full-time fire chief, six engineers, three captains, and 15 volunteers. The fire department has a command trailer, five fire engines, two rescue trucks, two mobile response units, a hazardous materials trailer, a mobile training unit, an aerial tower truck, and a training center (Hannum, 2012).

Table 3.4-13
Number of Arrests in Potentially Affected Jurisdictions, 2006 - 2012[1]

Year and Type Of Arrest	Fremont Co. Sheriff	Lander Police	Riverton Police	Carbon Co. Sheriff	Rawlins Police
2006					
Total Index Offense Arrests	33	54	100	16	102
Drug Abuse Violations	35	35	35	23	35
Other Offenses	602	473	1,152	409	1,268
Total Arrests	670	562	1,287	448	1,405
2007					
Total Index Offense Arrests	42	54	131	15	106
Drug Abuse Violations	16	30	56	17	41
Other Offenses	669	532	971	499	1,187
Total Arrests	727	616	1,158	531	1,334
2008					
Total Index Offense Arrests	48	75	233	11	95
Drug Abuse Violations	43	37	70	38	104
Other Offenses	600	529	1,044	482	1,038
Total Arrests	691	641	1,347	531	1,237
2009					
Total Index Offense Arrests	60	73	189	8	103
Drug Abuse Violations	43	37	90	38	73
Other Offenses	599	464	1,058	380	808
Total Arrests	702	574	1,337	426	984
2010					
Total Index Offense Arrests	28	84	203	8	73
Drug Abuse Violations	36	43	111	45	77
Other Offenses	414	703	1,092	341	687
Total Arrests	478	830	1,406	394	837
2011					
Total Index Offense Arrests	38	79	200	21	90
Drug Abuse Violations	39	38	108	44	61
Other Offenses	389	634	1,235	347	627
Total Arrests	466	751	1,543	412	778
2012[2]					
Total Index Offense Arrests	41	81	246	20	86
Drug Abuse Violations	33	57	115	19	75
Other Offenses	345	608	1,233	318	447
Total Arrests	419	746	1,594	357	608

1 Wyoming Attorney General, 2005 – 2011.
2 Stanford, 2014.

3.4.4.6 Fiscal Conditions

The minerals industry accounts for a substantial share of revenues to the state and local governments in Wyoming. Mineral producers pay state severance tax, county property (ad valorem-gross products) tax on production, and county property (ad valorem) tax on plants, mining, and wellhead equipment, pipelines, and other facilities used in mineral production and transportation operations. Because the Project Area is located in Fremont County, the Proposed Action would have the greatest effects on local government revenues in that county. Therefore, the description of local government revenues in this section focuses on Fremont County.

County Revenues. Over the past several years, the largest sources of revenue to Fremont County government have been property taxes, grants and contributions, and sales and use taxes. From 2006 to 2012, property taxes contributed between 24 percent and 35 percent of Fremont County's revenues (see Table 3.4-14). Grants and contributions, which include operating and capital grants, comprised between 22 percent and 35 percent of the county's budget (with capital grants accounting for most of the variation); and sales and use taxes comprised between 14 percent and 19 percent. In 2011, charges for services overtook sales and use tax as the county's third largest revenue source.

Fremont County receives payments from the federal government to help offset losses in property taxes due to non-taxable federal lands within its boundaries. These payments, known as Payments in Lieu of Taxes, or PILT, are made annually for tax exempt federal lands administered by the BLM, the NPS, the FWS, and for Federal water projects. Between 2006 and 2012, PILT accounted for between 4 percent and 11 percent of Fremont County revenues.

Table 3.4-14
Fremont County Budget Revenue Sources, 2006 – 2012[1] (million dollars)

Revenue Source	2006	2007	2008	2009	2010	2011	2012
Property Tax	$8.58	$11.27	$10.61	$7.61	$9.24	$7.72	$9.68
Grants & Contributions[2]	$11.00	$7.73	$14.19	$7.70	$6.89	$6.76	$8.25
Sales & Use Tax	$4.83	$4.83	$6.01	$4.54	$5.97	$4.60	$5.07
Charges for Services	$3.04	$3.52	$4.23	$4.49	$4.53	$4.68	$5.28
Federal PILT[3]	$1.58	$1.61	$1.56	$3.53	$1.85	$2.13	$2.33
State Assistance	$1.38	$0.97	$1.36	$1.15	$1.10	$0.88	$1.07
Investment Earnings	$0.03	$1.61	$1.54	$0.20	$0.86	$0.19	$0.67
Severance Tax	$0.45	$0.32	$0.39	$0.40	$0.41	$0.40	$0.39
Other	$0.36	$0.32	$0.54	$1.55	$0.62	$0.47	$0.32
Total County Revenue	$31.20	$32.20	$40.28	$31.17	$31.46	$27.84	$33.01

[1] Source: Fremont County, 2007 – 2013.
[2] Includes grants and contributions to the Fremont County fair, library, and museum.
[3] Payments in lieu of taxes (PILT).

Property Taxes. Mineral development, including uranium, affects a county's fiscal status largely through its impact on the property, or ad valorem, tax base. Ad valorem taxes are based on assessed valuations, which are determined, in part, by assessment rates. In Wyoming, mineral production is assessed at 100 percent of its fair market value, industrial property is assessed at 11.5 percent of its fair market value, and all other properties are assessed at 9.5 percent of fair market value.

Table 3.4-15 shows the increase in assessed valuations in Fremont County between 2005 and 2012. During this time, locally assessed valuations, which include agricultural, commercial, industrial, residential, and vacant land; and real and personal property, accounted for 19 percent to 50 percent of the county's total assessed valuation. Mineral production, nearly all of which consisted of natural gas and oil production, accounted for 47 percent to 79 percent of the county's assessed valuation (Campbell, 2012, Fremont County, 2013).

Table 3.4-15
Fremont County Assessed Valuation, 2005 - 2012 (million dollars)

Year	Locally Assessed Valuation	State Assessed Valuations				Total Assessed Valuation
		Utilities	Natural Gas	Oil	Other Minerals[1]	
2005[2]	$243.00	$18.77	$638.40	$84.71	$0.53	$985.40
2006[2]	$265.09	$19.52	$978.03	$112.41	$0.58	$1,375.64
2007[2]	$303.3	$20.19	$734.96	$131.27	$0.69	$1190.54
2008[2]	$344.77	$20.66	$337.91	$144.21	$0.94	$848.48
2009[2]	$367.18	$21.40	$463.71	$226.08	$1.08	$1,079.45
2010[2]	$381.99	$20.57	$211.38	$149.74	$0.88	$764.57
2011[2]	$385.16	$20.79	$315.85	$229.64	$0.71	$962.15
2012[3]	$385.64	$23.76	$314.13	$292.30	$0.72	$1,016.56

[1] Consists primarily of sand and gravel production.
[2] Source: Campbell, 2012.
[3] Source: Fremont County, 2013.

Severance Taxes. The State of Wyoming assesses a severance tax on uranium of 4.0 percent of the taxable value of the current year's production at the point where the production process is complete, before processing and transportation. The effective tax rate on uranium production is 1.8 percent (Temte, 2010). Uranium produced on federal lands is not subject to royalty payments.

Between 2001 and 2012, the taxable value of uranium produced in Wyoming ranged from $8.1 million to $42.9 million (see Table 3.4-16). This accounts for less than 1 percent of the total taxable value of mineral production in the state during the decade.

Table 3.4-16
Taxable Value of Uranium Production in Wyoming, 2001 - 2012[1] (million dollars)

	Mineral Production			Mineral Production	
Year[1]	**Uranium**	**All Minerals[2]**	**Year**	**Uranium**	**All Minerals[2]**
2001[3]	$13.0	$6,407.1	2007[3]	$17.0	$14,586.4
2002[3]	$10.2	$6,738.7	2007[3]	$19.9	$13,845.5
2003[3]	$9.1	$5,624.3	2009[3]	$11.4	$20,396.9
2004[3]	$8.1	$8,616.0	2010[4]	$22.7	$12,583.8
2005[3]	$9.3	$10,987.2	2011[5]	$32.7	$15,493.4
2006[3]	$12.3	$14,906.4	2012[6]	$42.9	$16,186.7

[1] Year tax revenue received, based on production during the previous calendar year.
[2] Includes natural gas, oil, coal, trona, bentonite, sand and gravel, uranium, decorative stone, clay, feldspar, granite, gypsum, silver, limestone, shale, gold, zeolite, leonardite, and moss rock.
[3] Wyoming Department of Revenue, 2009.
[4] Wyoming Department of Revenue, 2010.
[5] Wyoming Department of Revenue, 2011.
[6] Wyoming Department of Revenue, 2012.

Due to wide fluctuations in mineral prices and production levels, the Wyoming State Legislature changed the method through which severance taxes are distributed to state funds and entities in 2002. Prior to that time, state accounts received a fixed percentage of severance tax collections. Severance tax distributions were "de-earmarked" in 2002, and since then, the portion of total severance taxes going to individual funds has been based on a legislative formula and varies from year to year based on individual mineral valuations and overall severance tax totals. Between 2002 and 2011, severance tax distributions averaged 36 percent to the Permanent Wyoming Mineral Trust Fund Reserve; 28 percent to the state's budget reserve; 27 percent to the General Fund; 3 percent to cities or towns and counties; 3 percent to water development projects; 1 percent to the Leaking Underground Storage Tanks account; 1 percent to the Wyoming Highway Fund; 0.6 percent to road construction projects; and 0.5 percent to the state's capital construction account (Wyoming Department of Revenue, 2013).

3.4.4.7 Off-Site Processing at the Sweetwater Mill

The Sweetwater Mill is located in northeast Sweetwater County, approximately 33 miles south of the Project Area, 30 miles north of Wamsutter, 36 miles southwest of Bairoil, and 43 miles northwest of Rawlins. The Sweetwater Mill has been idle since the mid-1980s, and although extensive mineral development occurred in the surrounding area between the 1970s and mid-1990s, the area is currently characterized by open range and livestock grazing. Most of Sweetwater County's population lives near the Interstate-80 corridor in the southwestern part of the county. In 2013, over 80 percent of the county's population of 45,260 lived in Rock Springs and Green River, 98 and 123 miles, respectively, from the Sweetwater Mill. The communities closest to the Sweetwater Mill, Bairoil and Wamsutter, have experienced significant population shifts over the past 20 years. Between 1990 and 2013, Bairoil's population decreased from 228 to 110, and Wamsutter's population increased from 240 to 466 (WDAI, 2013a).

In 2012, annual wages averaged $41,550 in Sweetwater County. By industry, annual wages ranged from a high of $79,339 in the Mining sector to a low of $17,546 in the Accommodations and Food Services sector (BLS, 2014a). Personal income in Sweetwater County is heavily depending on earnings, which make up a larger portion of personal income in Sweetwater County than they do in Fremont and Carbon counties. Between 2001 and 2012, net earnings comprised approximately 75 percent of personal income in Sweetwater County, transfer payments comprised 9 percent, and dividends, interest and rent comprised 16 percent (BEA, 2014b).

Buoyed by oil and gas development, unemployment rates in Sweetwater County have generally been comparable to or lower than statewide unemployment rates and lower than unemployment rates in Fremont and Carbon counties since 2000. Between 2000 and 2013, the unemployment rate in Sweetwater County ranged from a low of 2.2 percent in 2007 to a high of 6.8 percent in 2010. In 2013, Sweetwater County's unemployment rate was 4.0 percent, compared to 4.6 percent for the State of Wyoming, 5.9 percent in Fremont County, and 4.5 percent in Carbon County (BLS, 2014b).

Most of the housing stock in Bairoil, Wamsutter and surrounding rural areas consists of owner-occupied single-family or mobile homes. Between 2008 and 2012, single-family homes and mobile homes accounted for all of the housing units in Bairoil, 94 percent of the housing units in Wamsutter, and 97 percent of the housing units in the Wamsutter Census County Division, which extends from the Fremont County line to the north, to just south of Interstate 80 to the south, and from near the Carbon County line to the east to Table Rock to the west. Owners occupied 98 percent of the occupied housing units in Bairoil, 59 percent of the occupied housing units in Wamsutter, and 74 percent of the occupied housing units in the Wamsutter Census County Division (Census Bureau, 2013b).

Bairoil and Wamsutter have limited community services. Historic enrollments at the now-closed Bairoil Elementary School (K–5) were discussed in Section 3.4.4.5 above. Between 2001 and 2013, enrollments at the Desert Elementary School (K–6) in Wamsutter ranged from 27 to 71 students (Wyoming Department of Education, 2014). Students from both towns are bussed to Rawlins for junior high and high school. The Wamsutter Community Health Clinic provides routine and urgent care medical services. The Wamsutter Volunteer Fire Department provides first-response fire and emergency services in eastern Sweetwater County. Fire District #1, dispatched out of Rock Springs, provides back-up fire response and Sweetwater Medic, also dispatched out of Rock Springs, provides back-up emergency medical response (Urbatsch, 2014).

Revenues to Sweetwater County government are highly dependent on mineral revenues. Between 2010 and 2012, mineral production, which included trona, crude oil, natural gas, and coal, accounted for between 62 and 70 percent of Sweetwater County's total assessed valuation (Sweetwater County, 2014). The Lost Creek Uranium In-Situ Recovery Project began operating in August of 2013. The Lost Creek Project is located in northeast Sweetwater County, approximately 15 miles southwest of Bairoil and 17 miles south of the Project Area.

3.4.5 Environmental Justice

Executive Order 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority and low-income populations. Minority populations are members of one of the following racial groups: Black/African-American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islanders, "other" races, or multi-racial (CEQ, 1997). According to the 2012 ACS, racial minorities comprised 8.8 percent of Wyoming's statewide population, 25.8 percent of Fremont County's population, 0.0 percent of the Jeffrey City Census County Division's population, and 9.1 percent of Carbon County's population between 2008 and 2012

(Census Bureau, 2013a). During this time, persons of Hispanic origin, who may be of any race, comprised 8.9 percent of Wyoming's population, 5.8 percent of Fremont County's population, 0.0 percent of the Jeffrey City Census County Division's population, and 16.7 percent of Carbon County's population.

The Census Bureau defines low-income populations as individuals whose income during the previous 12 months fell below the poverty level. According to the Census Bureau's Small Area Income and Poverty Estimates database, in 2012, low income populations comprised approximately 12 percent of the state's population, 16 percent of Fremont County's population, and 13 percent of Carbon County's population (Census Bureau, 2013b). Data on low income populations are not available for the Jeffrey City Census County Division. Table 3.4-17 summarizes racial, ethnicity, and poverty data in Wyoming and Fremont and Carbon counties, and the Jeffrey City Census County Division.

Table 3.4-17
Minority and Low Income Populations in
Fremont County, Carbon County, Jeffrey City Census County Division (CCD), and Wyoming, 2008 - 2012

Racial and Poverty Characteristics	Wyoming	Fremont County	Jeffrey City Census County Division[2]	Carbon County
Minority Populations[1]				
African American	0.8%	0.4%	0.0%	0.8%
American Indian & Alaska Native	2.3%	21.1%	0.0%	0.7%
Asian & Pacific Islander	0.8%	0.6%	0.0%	1.2%
Some Other Race	2.1%	1.1%	0.0%	3.6%
Two or More Races	2.7%	2.5%	0.0%	2.9%
Total Racial Minorities	8.8%	25.8%	0.0%	9.1%
Hispanic (ethnicity)[2]	8.9%	5.8%	0.0%	16.7%
Low Income Populations[3]				
Median Household Income	$55,104	$47,906	NA[5]	$53,780
Percent of Individuals in Poverty[4]	11.9%	16.2%	NA[5]	13.4%

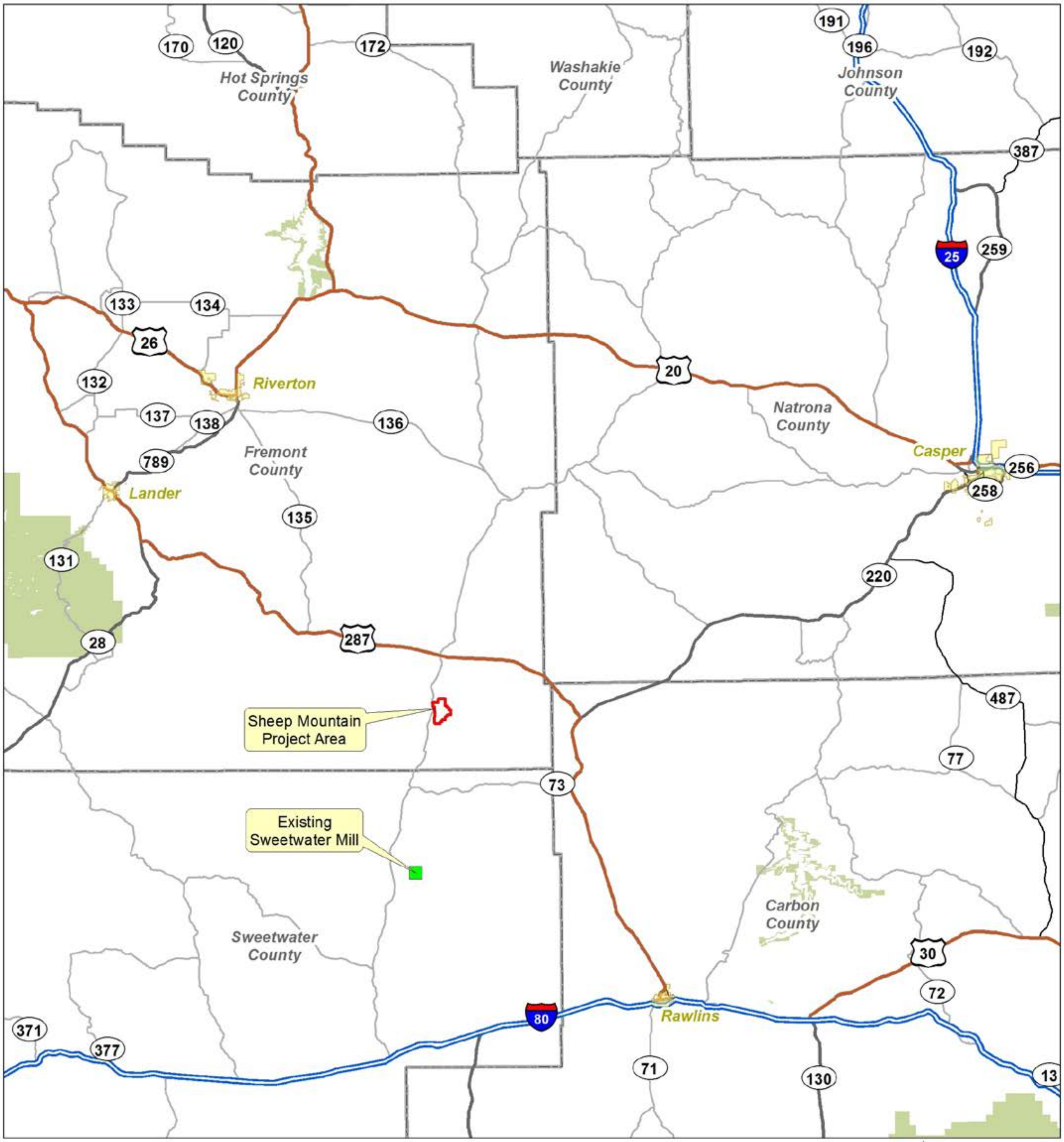
[1] Source: Census Bureau, 2013a.
[2] Hispanic origin is considered an ethnicity, not a race. Hispanics may be of any race.
[3] Source: Census Bureau, 2013b.
[4] Percent of individuals whose income in the previous 12 months was below the poverty level.
[5] NA=Not Available. The Census Bureau's Small Area Income and Poverty Estimates (Census Bureau, 2013b) do not report income and poverty data for CCDs.

Off Site Processing at the Sweetwater Mill. Between 2008 and 2012, racial minorities comprised 8.3 percent of Sweetwater County's population and persons of Hispanic origin comprised 15.2 percent (Census Bureau, 2013a). In 2012, low-income populations comprised 8.4 percent of Sweetwater County's population (Census Bureau, 2013b).

3.4.6 Transportation/Access

3.4.6.1 Access Roads

The Project Area is located in the southeast corner of Fremont County, approximately 60 miles from Lander, 62 miles from Riverton, 65 miles from Rawlins, and 105 miles from Casper. Map 3.4-1 shows the regional roadway system. US Highway 287 and Wyoming state highways 789 and 135 link the Project Area to Lander and Riverton. US Highway 287 and Wyoming State Highway (WY 789) are the same road between Rawlins and Sweetwater Station. US Highway 287/WY 789 links the Project Area to Rawlins and Interstate-80. US Highway 287/WY 789 and WY 220 link the Project Area to Casper and Interstate 25. Because it is likely that some Project-related traffic would originate in Casper, WY 220 in Natrona County is included in reporting of current traffic levels in this section.



Map 3.4-1
Regional Roadway System

Sheep Mountain Project Area

0 15 30
Miles

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The Project Area is accessed directly by Crooks Gap/Wamsutter Road (Fremont County Road 318), which connects to US Highway 287/WY 789 at Jeffrey City, 8 miles north of the Project Area. To the south, Crooks Gap/Wamsutter Road enters Sweetwater County, where it becomes Sweetwater County Road 4-23 (also known as Crooks Gap/Wamsutter Road) and intersects Interstate-80 at Wamsutter, 53 miles south of the Project Area. The entire length of Crooks Gap/Wamsutter Road is unpaved with an improved gravel surface. Although there are several unimproved roads in the vicinity of the Project Area, many of these roads are not maintained or open during the winter.

Table 3.4-18 shows 2010 and 2011 annual average daily traffic (AADT) volumes on highways in the vicinity of the Project Area. Between 2010 and 2011, traffic levels remained relatively constant on US Highway 287/WY 789 between Rawlins and Muddy Gap, and on WY 220 between Muddy Gap and Casper. During this time, AADT on segments of US Highway 287 between Muddy Gap and Lander decreased by an average of 7 percent, and AADT on segments of WY 135 between Sweetwater Station and Riverton decreased by an average of 23 percent (WYDOT, 2012a). The decrease in traffic on WY 135 corresponds to completion of the Wind River Hotel and Casino near Riverton.

3.4.6.2 Road Maintenance

WYDOT maintains US Highway 287/WY 789, WY 135, and WY 220. Fremont County and Sweetwater County are responsible for maintaining their respective portions of Crooks Gap/Wamsutter Road. In both counties, the Crooks Gap/Wamsutter Road is treated with magnesium chloride and has no vehicle or weight restrictions. Southern portions of the road are frequently impassible in the winter due to blowing snow (Buffington, 2011). Winter road conditions tend to be better on northern portions of Crooks Gap/Wamsutter Road between US Highway 287/WY 789 and the Project Area because there are snow fences and the road has been elevated to be above blowing snow (Brody, 2012). This portion of Crooks Gap/Wamsutter Road also provides access to the Crooks Gap oil field which is located northwest of the Project Area (see Map 3.2-6).

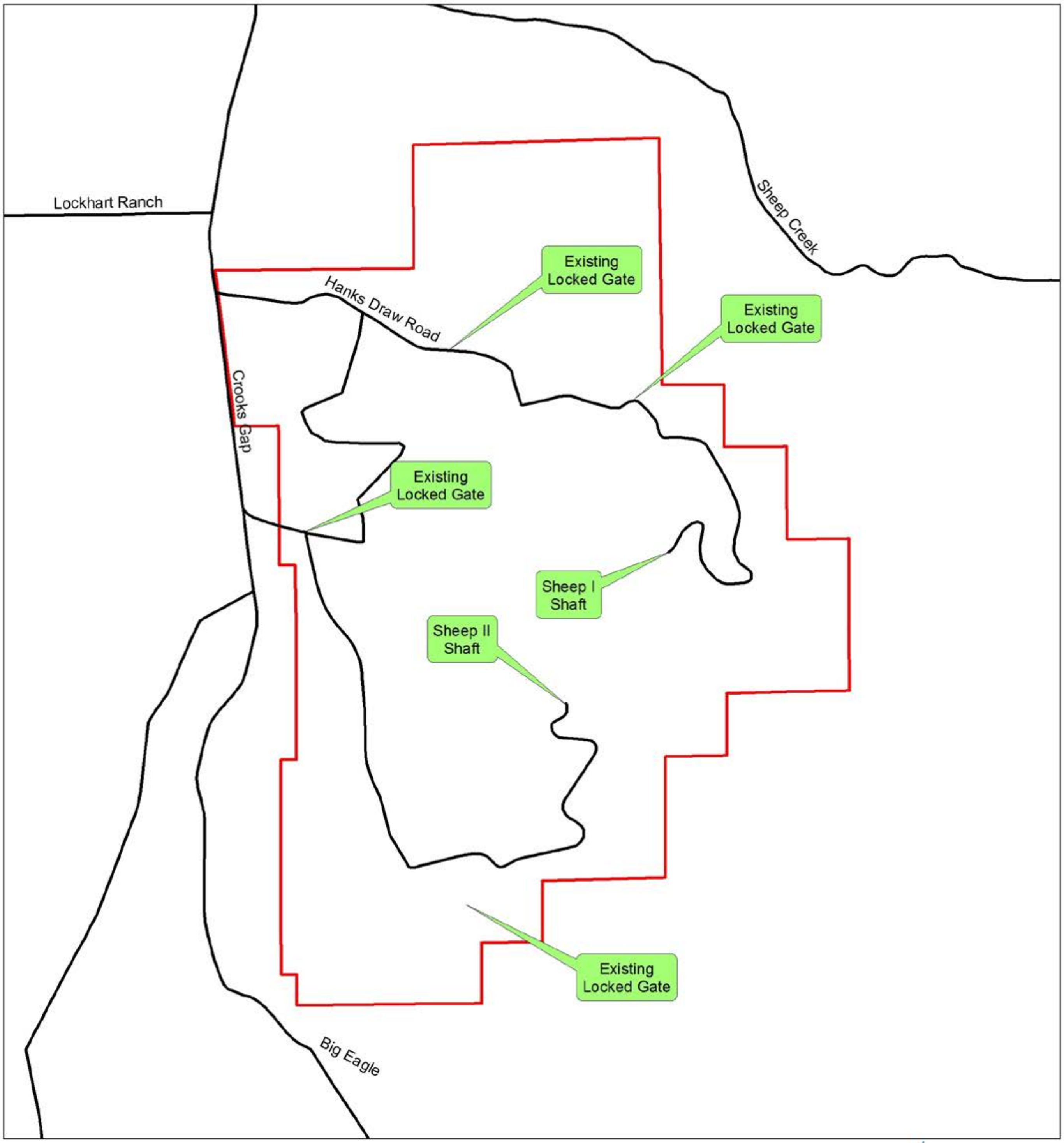
3.4.6.3 On-Site Roads

Two gravel-surfaced roads provide access from Crooks Gap/Wamsutter Road into the Project Area, but access is restricted to the public by locked gates (see Map 3.4-2). The northern access route (Hanks Draw Road) begins near the site’s northwest corner and travels 3.46 miles along Hanks Draw to the Congo Pit and Sheep I Shaft. The southern access road exits Crooks Gap/Wamsutter Road approximately 1 mile south of Hanks Draw Road, and travels 3.26 miles to the Sheep II Shaft. The road originally continued on to meet Hanks Draw Road at the Sheep I mine shaft, but due to surface drainage and erosion problems, Energy Fuels reclaimed the road between the Sheep I and Sheep II shafts in 2010 (BRS Engineering, 2011). Several driveable two track roads and many more unpassable drilling roads dissect the Project Area, but are not described here in detail because they have not been inventoried and do not attribute to traffic within the Project Area.

Table 3.4-18
Annual Average Daily Traffic on Highways in the Vicinity of the Project Area, 2010 and 2011[1]

Route and Highway Segment Description	Milepost		2010[1]		2011[2]	
	Start	End	All Vehicles	Trucks[3]	All Vehicles	Trucks[3]
Rawlins to Lander: US Highway 287/WY 789						
Jct US 30 Bus Rte & I-80 Bus Rte	0.197	1.187	4,746	311	4,870	356
Rawlins northern city limits	1.187	1.919	3,559	329	3,609	264
US Highway 287 Bypass	1.919	3.090	5,241	573	5,153	389
Rawlins northern urban limits	3.090	15.250	3,839	562	3,893	285
Union 76 Mine Road Junction	15.250	33.264	3,536	560	3,536	509
Junction WY 73 at Lamont	33.264	44.311	2,259	558	2,338	590
Muddy Gap Junction	0.000	6.412	901	124	790	107
Carbon – Fremont county line	6.421	6.518	960	124	946	107
Fremont – Natrona county line	6.518	7.917	960	124	946	107
Natrona – Fremont county line	7.917	22.410	960	124	946	107
Jeffrey City – east side	22.410	23.400	1,072	141	1,056	118
Jeffrey City – west side	23.400	41.900	958	141	958	118
Bison Basin Road	41.900	42.106	1,447	129	1,129	109
WY 135 Junction	42.106	46.340	872	129	755	109
Antelope Creek	46.340	54.129	842	124	842	108
Old Highway Junction	54.129	72.868	773	129	742	107
WY 28 Junction	72.868	74.440	1,686	358	2,186	315
Willow Creek Road Junction	74.440	79.230	3,409	368	2,682	325
Lander southern urban limits	79.230	80.195	5,617	368	4,498	329
Lander southern city limits	80.195	80.770	6,704	440	6,798	401
Sweetwater Junction to Riverton: WY 789 , WY 135 and WY 136						
WY State Highway 789						
WY 135 Junction	103.835	104.162	18,000	705	12,410	703
Riverton southern urban limits	104.162	104.308	19,000	754	13,792	749
Riverton southern city limits	104.308	105.169	19,126	758	16,086	753
WY State Highway 135						
WY 789 Junction	0.000	1.040	1,378	200	1,364	207
WY 136 Junction	1.040	7.351	857	120	847	129
Wind River Indian Reservation	7.351	8.850	739	100	731	111
Route Road 524 West Junction	8.850	17.577	583	97	488	74
WY139 Junction	17.577	34.590	570	95	464	71
WY State Highway 136						
WY 135 Junction	1.038	12.123	225	38	222	34
Muddy Gap to Casper: WY 220						
Muddy Gap	44.311	57.014	1,825	534	1,894	563
Carbon –Natrona county line	57.014	65.674	1,825	534	1,894	563
Buzzard Road Junction	65.674	80.660	2,012	533	1,982	533
Pathfinder Road Junction	80.660	84.660	2,286	591	2,281	591
Lake Shore Drive Junction	84.660	86.640	2,730	701	2,689	701
Kortes Road Junction	86.640	97.350	3,022	697	2,977	697
WY 487 Junction	97.305	102.905	3,579	688	3,567	689
Old Highway Junction	102.905	105.805	3,605	863	3.705	863
Goose Egg Road Junction	105.805	107.963	3,663	988	3,656	988
Casper southern urban limits	107.963	108.060	4,854	988	4,902	988

[1] WYDOT, 2011.
[2] WYDOT, 2012a.
[3] For purposes of reporting AADT, the WYDOT defines a truck as any vehicle larger than a pick-up (Wiseman, 2014).

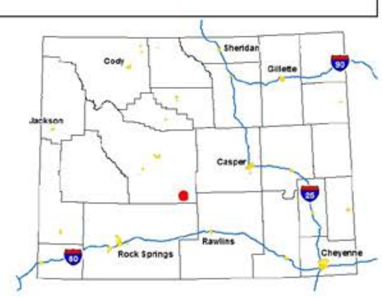


Map 3.4-2
Existing Roads within the Project Area

0 2,000 4,000 Feet

No warranty is made by the Bureau of Land Management (BLM) for use of the data for purposes not intended by the BLM

Sheep Mountain Project Area
Existing Roads



3.4.6.4 Traffic Crashes

Table 3.4-19 shows the number of traffic crashes involving property damage, injuries, and fatalities in Carbon, Fremont, and Natrona counties between 2005 and 2012 (incomplete data are available for 2008 and 2010). Crash data were obtained from the WYDOT, and include traffic crash reports submitted by all levels of Wyoming law enforcement.

Table 3.4-19
Traffic Crashes by Type for Fremont, Carbon and Natrona Counties, 2005 - 2011[1]

Year	Crash Type	Carbon County	Fremont County	Natrona County
2005	PDO[2]	575	680	1,852
	Injury	209	243	598
	Fatal	5	13	11
2006	PDO[2]	689	625	1,796
	Injury	202	246	635
	Fatal	13	19	10
2007	PDO[2]	724	743	1,935
	Injury	238	234	625
	Fatal	8	15	10
2008	PDO[2]	NR[3]	NR[3]	NR[3]
	Injury	NR[3]	NR[3]	NR[3]
	Fatal	6	18	13
2009	PDO[2]	526	693	1,898
	Injury	136	219	582
	Fatal	7	20	11
2010	PDO[2]	NR[3]	NR[3]	NR[3]
	Injury	NR[3]	NR[3]	NR[3]
	Fatal	15	12	8
2011	PDO[2]	569	705	1,727
	Injury	127	171	504
	Fatal	8	11	13
2012[4]	PDO[2]	552	666	1,763
	Injury	137	194	432
	Fatal	7	9	10

[1] Source: WYDOT, 2013.
[2] PDO = property damage only.
[3] NR = Not Reported.
[4] Source: WYDOT, 2014.

Fatality rate data compiled by the National Highway Traffic Safety Administration (NHTSA) provide additional information on fatal traffic crashes. Table 3.4-20 shows the number of highway fatalities and highway fatality rates (expressed as fatalities per million vehicle miles traveled) in urban and rural areas of Wyoming between 2008 and 2012. The NHTSA classifies geographic areas as rural or urban as defined by the Census Bureau. Urban areas identified by the Census Bureau contain urbanized areas of 50,000 or more people and urban clusters of at least 2,500 and less than 50,000 people. Rural areas include all population, housing, and territory not included within an urban area.

Table 3.4-20
Wyoming Highway Fatalities and
Fatality Rates per Million Vehicle Miles Traveled, 2005 - 2011[1]

Traffic Safety Measure	2008	2009	2010	2011	2012
Traffic Fatalities					
Urban	22	19	22	38	22
Rural	137	115	133	97	101
Total	159	134	155	135	123
Fatalities per 100 Million Vehicle Miles Driven					
Urban	0.83	0.71	0.80	1.39	0.77
Rural	2.02	1.67	2.01	1.49	1.57
Total	1.68	1.40	1.66	1.46	1.33
[1] Source: NHTSA, 2013.					

3.4.6.5 Off Site Processing at the Sweetwater Mill

If processing occurred at the Sweetwater Mill, ore-hauling trucks would travel approximately 26 miles south of the Project Area on Crooks Gap/Wamsutter Road (Fremont CR 318 and Sweetwater County CR 4-23) to Mineral Exploration Road (Sweetwater CR 4-63). Project traffic would exit east onto Mineral Exploration Road and continue approximately 4 miles to the Sweetwater Mill entry road. From the mill, the processed product would travel approximately 20 miles east on Mineral Exploration Road to the Carbon County line and continue approximately 10 miles east on BLM Road 3206 to access US Highway 287 north of Rawlins. Weather permitting, trucks hauling drums leaving the Sweetwater Mill could also travel 22 miles south on Crooks Gap/Wamsutter Road to access Interstate-80 at Wamsutter. Workers might also use Bairoil Road (Sweetwater CR 4-22) to access the Sweetwater Mill from Bairoil.

In their comment letter on the Preliminary Draft EIS dated February 23, 2015 Sweetwater County summarized the current condition of Crooks Gap/Wamsutter Road (4-23), Minerals Exploration road (4-63), and the Bairoil Road (4-22):

- Crooks Gap/Wamsutter Road (4-23) – The portion of the Crooks Gap/Wamsutter Road located north of the Luman Road (4-23) is currently a county dirt road that receives winter maintenance by agreement with UR Energy and the Lost Creek Mine. Through this cooperative agreement, UR Energy and Sweetwater County have upgraded a portion of this road section to an improved gravel road that will accommodate a moderate number of light weight vehicles on a daily basis and a few heavy haul vehicles on a weekly basis.
- Minerals Exploration Road (4-63) – The Minerals Exploration Road is currently a paved road from US Highway 287 to the Sweetwater Mill. Within Sweetwater County, the paved surface of this road is in poor condition and receives only occasional maintenance. Within Carbon County, the BLM portion of this road has weight restrictions that limit the use of this road as a haul road for heavy trucks.
- Bairoil Road (4-22) – Due to the presence of large stones and cobble and the sandy nature of the road base and substrate, the Bairoil Road is in very poor condition and is extremely difficult to maintain.

Fremont County and Sweetwater County provide winter maintenance on their respective portions of Crooks Gap/Wamsutter Road and Sweetwater County provides winter maintenance on Minerals Exploration Road; however, county maintenance crews do not plow these roads during periods of inclement winter weather. Sweetwater County does not maintain Bairoil Road in the winter. The BLM provides minimal maintenance on BLM Road 3206. The Sweetwater Mill has a BLM right-of-way on this route and conducts periodic roadway maintenance as part of its right-of-way agreement.

3.4.7 Public Health and Safety

Public health and safety includes the potential exposure of the public and workers to radioactivity, generation of solid waste, and transportation and use of hazardous materials. The following section describes the kinds of radioactive materials that would be generated through ore processing and radioactive background that could be encountered on-site from past mining activities. It also provides a discussion of the regulatory framework of how various hazardous materials and solid wastes are defined under numerous programs.

3.4.7.1 Exposure to Radioactive Materials

Radioactive exposure is measured by a quantity called the roentgen and is a measurement of the ionization of molecules in a given mass of air by gamma rays or x-rays. A unit called the roentgen equivalent man (rem) is used to relate the radiation exposure to potential live tissue damage since different kinds of radioactivity can cause different effects even for the same amount of absorbed radiation. The rem is often expressed in terms of millirem (mrem).

The annual natural background radiation exposure to U.S. residents varies by location and elevation but is about 360 mrem per year (mrem/yr) (NRC, 2013). The average U.S. resident also receives additional radiation exposure from manmade sources such as medical tests and consumer products. Table 3.4-21 compares various radiation exposures from activities or exposure thresholds.

Table 3.4-21
Comparative Doses of Radiation

Activity or Limit	Dose
Annual natural background radiation in U.S.	360 mrem
Flying 3,000 miles	3 mrem
Chest x-ray	10 mrem
CT scan	500 – 1,000 mrem
Annual whole body limit for workers	5,000 mrem
Annual thyroid limit for workers	50,000 mrem
Radiation sickness (Acute Radiation Syndrome)	100,000 mrem whole body
Erythemia (skin reddening)	500,000 mrem to skin
Source: BLM, 2013b.	

Background doses of radiation typically are a function of elevation change. An increase in elevation correlates to an increase in the exposure to cosmic radiation. The average cosmic radiation in the Project Area is expected to be greater than the national average due to its higher elevation. The average natural and manmade radiation dose for the State of Wyoming is 316 mrem/yr, lower than the U.S. average. This is attributable to a lower Wyoming average radon dose, 133 mrem/yr, than the U.S. average of 200 mrem/yr (EPA, 2005).

The principal radiological parameters of concern, based on potential health effects, are radium-226 and its immediate daughter product radon-222. Because radon is a gas which readily disperses in an open air environment, the radiological parameter most commonly evaluated in soils and/or mine spoils is radium-226. As radioactive materials by definition decay and emit radioactive particles and/or energy, the general levels of radioactivity can readily be measured by passive detection devices. Naturally occurring uranium results in the formation of radon-222, a radioactive gas. Radon gas is formed through the radioactive decay of uranium. Uranium and radon are ubiquitous in the U.S. although concentrations vary regionally and depend on the amount of uranium present in the soil, rocks, and water (EPA, 2012). The presence of radon is dependent on the type, porosity, and moisture content in the soil and/or bedrock.

As provided in Section 3.2.1 (Climate and Air Quality), passive gamma dose rate and radon measuring devices were co-located with nine air particulate monitoring stations. Monitored results indicate relatively low radio particulate concentrations in air across the site (Titan Uranium, 2011).

As provided in Section 3.2.4 (Soils), a report for the Project Area was completed summarizing the baseline gamma levels and commensurate radium-226 levels in the soils (WDEQ, 2015a).

In general, the Project Area shows relatively high radiological background gamma due to both NORM and TENORM concentrations of Radium 226 and other radionuclides in the near surface soils. Elevated NORM is due to outcropping of mineralization. Elevated TENORM reflects the more than 30 years of historical mining and exploration in the vicinity.

Radiation exposure limits are specified in 10 CFR § 20. Both the Occupational Safety and Health Administration (OSHA) and the NRC, through an MOU, have jurisdiction over occupational safety and health at NRC-licensed facilities (OSHA, 1988).

3.4.7.2 Wastes, Hazardous or Solid

Solid Waste

Solid waste consists of a broad range of materials that include garbage, refuse, wastewater treatment plant sludge, non-hazardous industrial waste, and other materials (solid, liquid, or contained gaseous substances) resulting from industrial, commercial, mining, agricultural, and community activities. Solid wastes are regulated under different subtitles of the Resource Conservation and Recovery Act (RCRA) and include hazardous waste and non-hazardous waste and certain radioactive wastes.

Hazardous Materials (Non-Radioactive)

Hazardous materials, which are defined in various ways under a number of regulatory programs, can represent potential risks to both human health and the environment when not properly managed. The term ‘hazardous materials’ includes the following materials that may be utilized or disposed of in construction and operation:

- Substances covered under OSHA Hazard Communication Standards (29 CFR § 1910.1200 and 30 CFR § 42): The standard covers many chemicals and substances commonly used at industrial worksites.
- “Hazardous materials" as defined under USDOT regulations at 49 CFR, §§ 170-177: The types of materials that may be used in construction and operational activities and that would be subject to these regulations would include, cement, fuels, some paints and coatings, and other chemical products.
- “Hazardous substances” as defined by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and listed in 40 CFR Table 302.4: The types of materials that may contain hazardous substances that would be subject to these requirements would include solvent-containing materials (e.g., paints, coatings, degreasers), acids, and other chemical products.
- “Hazardous wastes” as defined in the RCRA: Procedures in 40 CFR § 262 are used to determine whether a waste is a hazardous waste. Hazardous wastes are regulated under Subtitle C of RCRA.
- Any “hazardous substances” and "extremely hazardous substances" as well as petroleum products such as gasoline, diesel, or propane, that are subject to reporting requirements if volumes on-hand exceed threshold planning quantities under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act (SARA): The types of materials that may be used in construction and operational activities and that could be

subject to these requirements would include fuels, coolants, acids, and solvent-containing products such as paints and coatings.

- Petroleum products defined as "oil" in the Oil Pollution Act of 1990: The types of materials that would be subject to these requirements include fuels, lubricants, hydraulic oil, and transmission fluids.

In conjunction with the definitions noted above, the following provides information regarding management requirements during transportation, storage, and use of particular hazardous chemicals, substances, or materials:

- The SARA Title III List of Lists or the Consolidated List of Chemicals Subject to Emergency Planning and Community Right-to-Know Act and Section 112(r) of the Clean Air Act.
- The USDOT listing of hazardous materials in 49 CFR § 172.101.

Certain types of materials, while they may contain potentially hazardous constituents, are specifically exempt from regulation as hazardous wastes. Used oil, for example, may contain toxic metals, but would not be considered a hazardous waste unless it meets certain criteria. Other wastes that might otherwise be classified as hazardous are managed as "universal wastes" and are exempted from hazardous waste regulation as long as those materials are handled in ways specifically defined by regulation. An example of a material that could be managed as a universal waste is lead-acid batteries. As long as lead-acid batteries are recycled appropriately, requirements for hazardous waste do not apply.

Radioactive Waste

The remaining waste products following the extraction and recovery of uranium from ore through processing operations are classified as "11(e)(2) byproduct material." According to Section 11(e)(2) of the AEA (as revised in 1978 and in 2005 by the Energy Policy Act), byproduct material is defined as "the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." Byproduct material is not considered a hazardous waste under EPA regulations. To be a hazardous waste, material must first be classified as a solid waste by EPA. Under the RCRA regulation 40 CFR § 261.4(a)(4), source, special nuclear, or byproduct material as defined by the AEA is excluded from the definition of solid waste.

The NRC and states under agreement with the NRC regulate the disposal of byproduct material. The NRC licenses commercial facilities that handle or use radioactive materials including nuclear power reactors, non-power research, test and training reactors, fuel cycle facilities, medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and waste. The NRC is also responsible for developing, implementing, and enforcing NRC licensing criteria.

3.5 LAND RESOURCES

3.5.1 Recreation

Typically, the BLM describes the recreational setting based on three main factors: the character of the natural landscape (Physical Setting), the character of recreation and tourism use (Social Setting); and how public land agencies, county commissioners, the private sector, and open-space administrators manage the area (Administrative Setting). The factors combine as descriptors of the recreation environment that can result in a spectrum of recreation settings ranging from primitive or pristine to urban.

The Project Area and vicinity provides opportunities for primarily the local public to experience recreational activities in a highly modified front-country setting. While not urban, the high level of existing disturbance in terms of roads and trails, pits and other developments, represent uncharacteristically modified recreational opportunities.

Hunters have historically used the road–trail network in the area that exists from previous mining operations. Western Nuclear Pond to the south of the Project Area is used by the local community for fishing.

The Project Area coincides with two pronghorn hunt areas (HA 68-Split Rock north and HA 61-Chain Lakes south) and one hunt area each for mule deer (HA 96-Green Mountain), elk (HA 24-Green Mountain), and moose (HA 39-Jeffrey City). In addition to monitoring big game harvests, the WGFD documents the numbers of hunters, hunter success, number of days spent by hunters during the hunt season (hunter days), and average time to harvest each animal (days per harvest) within each hunt area each year. The moose hunt area has been closed to hunting for the past 10 years, 2003 to 2012 but harvest and recreational use of hunt areas for the big game species is documented in Table 3.5-1. The data summarized for the past 10 years indicate that numbers of pronghorn, mule deer, and elk hunters in the Project Area have been increasing. Mule deer hunters spent the most recreational time in the area in part due to their increasing numbers but also because they averaged more time to harvest a deer each year than pronghorn and elk hunters. As noted in Section 3.3.5.1 under Wildlife, the Sweetwater mule deer population and Green Mountain elk population have been increasing over the past 20 years and, if the trends continue, recreational harvests of those species is likely to continue increasing in the vicinity of the Project Area. However, the recent declining population trend of the Beaver Rim pronghorn population does not appear to have affected hunter use of HA 68.

Table 3.5-1
Hunter Recreation Use of Big Game Hunt Areas that Coincide with the Project Area

Big Game Species and Hunt Area	10-year Average Number of Hunters (10-year Trend)	10-year Average % Hunter Success (10-year Trend)	10-year Average Hunter Days (10-year Trend)	10-year Average Days per Harvest (10-year Trend)
Pronghorn				
HA 68	427 hunters (increasing)	96.0 percent (no trend)	1,267 hunter days (increasing)	3.0 (increasing)
HA 61	250 hunters (no trend)	93.9 percent (no trend)	627 hunter days (no trend)	2.7 (no trend)
Mule Deer				
HA 96	624 hunters (increasing)	40.0 percent (no trend)	2,219 hunter days (increasing)	10.8 days (no trend)
Elk				
HA 24	359 hunters (increasing)	56.5 percent (decreasing)	1,952 hunter days (increasing)	9.8 days (increasing)
Sources: WGFD. 2003 to 2012.				

The vicinity of the Project Area is also used for recreational harvest of upland game birds in 2012 including mourning dove, ruffed grouse, chukar, blue grouse, gray partridge, and greater sage-grouse. Small game hunters potentially use the Project Area vicinity, primarily to harvest cottontail rabbits and possibly squirrels. Various furbearers (bobcat, badger, beaver, mink, and muskrat) may also be trapped in the area although furbearer harvest is more limited than recreational harvest of upland game birds and small game mammals.

The social recreation setting in the area is demonstrating an urbanizing trend or movement towards more modified recreation settings due to existing mineral development, transmission lines, increased pipelines, and compressor stations.

No developed recreation sites exist in or near the Project Area. The closest developed sites are on Green Mountain and consist of county- and BLM-maintained camping areas and upgraded access roads. Informal camping occurs around the Project Area and vicinity during hunting seasons.

3.5.2 Livestock Grazing

The Project Area coincides with two grazing allotments (see Map 3.5-1). The Mountain Allotment consists of approximately 36,286 acres, and the Project Area coincides with 2,976.93 of those acres (or less than 10 percent of the allotment). The Crooks Gap Allotment consists of approximately 3,410 acres, and the Project Area coincides with 634.36 of those acres (or less than 20 percent of the allotment).

There are no range infrastructure projects in the Project Area associated with livestock grazing although approximately 1.67 miles of fencing are found in the Project Area erected to protect mine properties or by the Abandoned Mine Lands Program. These fences are shown on Map 3.5-1.

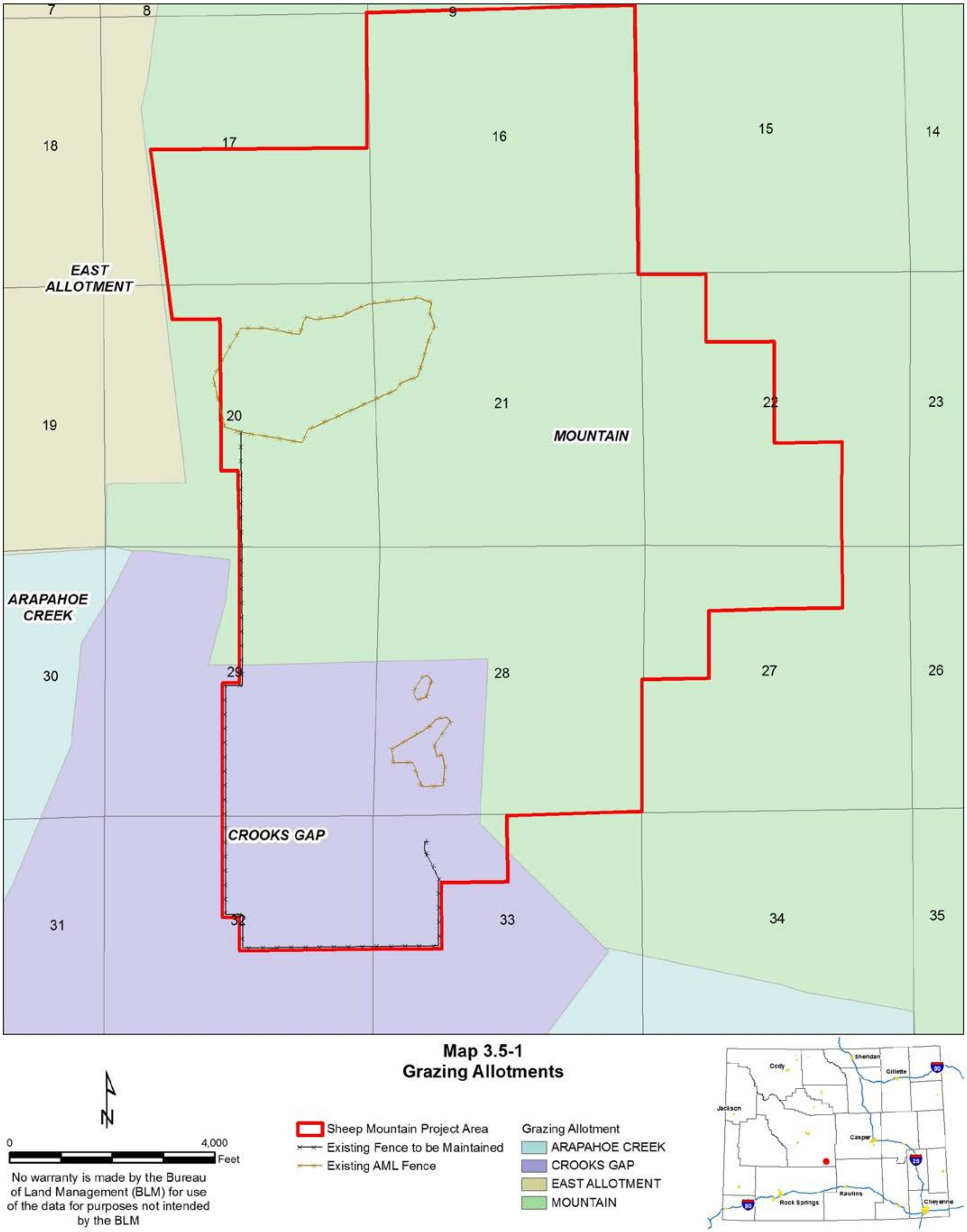
The BLM authorizes livestock grazing by season of use and by livestock numbers (AUMs), which represent the use of rangelands by a cow/calf pair for one month. The Mountain Allotment was formerly part of a larger allotment which was typically grazed from May to November. It is likely that this usage will be carried forward with authorized AUMs based on available forage. The Mountain Allotment is too new to have average usage.

The Crooks Gap Allotment portion of the Project Area has a season of use from October 1 to November 30th for 83 AUMs on public lands.

The range condition of the Crooks Gap Allotment portion of the Project Area does not vary meaningfully from the Mountain Allotment portion (Likins, 2012). Rangeland health was last assessed in this area in 1999 and was determined not to meet standards because of livestock grazing, primarily in riparian areas. A series of corrective actions for the area in general have been implemented but not in any way for the portions of the allotments in the Project Area.

The Lander Field Office has implemented a “block” approach to conducting rangeland health assessments. The two allotments coinciding with the Project Area are not currently scheduled for new assessments but the BLM’s goal is to conduct health assessments as part of livestock grazing permit renewals. While permits are issued for a ten-year period, BLM staffing does not always support doing rangeland health assessments in that timeframe. It is not possible to speculate as to what standards assessment would identify as current range condition (see Section 3.3.2, Vegetation).

The contribution of the rangeland in the Project Area to livestock grazing is minor and not proportionate to the acres. Because of existing surface disturbance or lack of vegetation associated with earlier mining operations and inhospitable terrain with steep slopes and limited water sources, the unfenced portions of the Project Area have a low carrying capacity. The fenced portions exclude livestock and thus do not contribute at all to the allotments. A formal ecological site inventory or carrying capacity has not been done in some decades and not since the last two severe droughts. However, BLM range specialists have analyzed the vegetation of the area coupled with other factors including slope and determined that the unfenced portions of the allotment would support livestock grazing at 40 acres per AUM (Bryan, 2013).



Map 3.5-1
Grazing Allotments

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